JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXVI., No. 2531.——TUESDAY, NOVEMBER 14, 1911.

EDITORIAL NOTES—GAS, &c.

The Revival of Coal-Liming.

HISTORY had a large part in the discussion on the paper that Mr. James Paterson read, at the Southern Association meeting on Thursday last, on the achievements at Cheltenham Gas-Works that are attributable to the coal-liming process as practised there. The occasion itself will, we venture to think, be historical in relation to purification matters. Coal-liming, in gas manufacture, as he shows, is nearly as old as the gas industry itself; but never before has the process been applied in a manner that has given continuous practical results, and such substantial results, as at Cheltenham, without apparent disadvantage. There is all the difference between an idea, and the application of it in practical fashion. Modesty dictated to Mr. Paterson that he should not draw any contrasts between the methods of those who years since worked on the liming of coal and the refined powdered lime process as practised at Cheltenham, and to which difference (as Mr. Charles Carpenter agrees) there may be due a larger proportion of the success than at first sight appears. This point has been emphasized in previous articles on the subject in these columns; but, as we say, Mr. Paterson does not in his paper make any pronounced allusion to it. He, however, says there are points which "may have"—mark the "may"—a partial bearing on the correct explanation of what has been accomplished. These points are that the retorts at Cheltenham are tile built, are 10 feet long, with stopped ends, light charges are used, and there is no hydraulic main. Now all these conditions were in existence before the advent of coal-liming there, when there were all the trouble and disadvantages that coal-liming, within the Cheltenham experience, has cured. Under the circumstances, if Mr. Paterson really suggests that these pre-existing conditions are partially responsible for the success of the coal-liming process, it follows that, if true, the coal-liming process can have small application elsewhere to realize the Cheltenham results. We do not, however, think that he has any information that would justify him saying that under other retort-house conditions—conditions diametrically opposed to those with which he has experience—the appilcation of lime as at Cheltenham would not have similar effects.

The plain fact, as was pointed out in the special article in the "JOURNAL" for Oct. 10, is that the author of the paper cannot—any more than can at present Mr. R. O. Paterson or his assistant (Mr. L. E. Twycross) who has been working with him in originating the process—account in any way whatever for the uniformly good advantages that have obtained since the systematic and regulated liming of the coal was introduced at Cheltenham. Mr. Paterson, in his paper, in effect, says: "There are our results and experi-"ences over about eighteen months' working. What do "you think of them? And can you assist us by furnishing "some elucidation of the changes which have apparently "been produced by the process?" Suggestions may be made by those chemically qualified to do so; but no one at the meeting could unreel any that were wholly acceptable, without investigation. Dr. Rudolf Lessing made an attempt—it was a clever attempt—at a theoretical explanation of the various phenomena; but, as he himself would readily admit, it is all more or less the hypothetical product, which may or may not prove true, of the mind capable, by training and knowledge, to reason out probable causes for certain effects which can be employed as directive in subsequent research. From this point of view, Dr. Lessing's contribution to the discussion will be highly valuable. There is the material here for a scientific chemical investigation for the purpose of positively ascertaining what are the causes that, on the surface, are perplexing. The points are not many that require treatment and elucidation; and they are all accessible. It is not difficult to understand the much lessened grains of sulphur compounds in the finished gas by the application to the coal of powdered lime as performed at Cheltenham—a reduction, in fact, to a little above 20 grains per 100 cubic feet, using a mixture of South Yorkshire and Derbyshire coal. And yet, on the evidence of use (but only on such evidence), the coke is not more sulphury than formerly. More information is required as to the sulphur; and the suggestion of Dr. Lessing that Mr. Paterson should by analysis endeavour to establish a sulphur balance so as to ascertain precisely what happens is a good one, and one that it is to be hoped will be acted upon, and that early. There is a point, which we think important, that Mr. Paterson did not mention in the paper—the amount of dust which is quite hot, denoting the presence of a high percentage of sulphur, that is shed by the coke as it is taken from the retorts to, and is passed through, the coke-screen; and there has also to be accounted for the extra dust that is found in the main flues of the retort-benches since the limed coke has been used for feeding the furnaces.

There is further the question of the freedom of the ascension-pipes from stoppages following the adoption of the liming process as part of the daily working at Cheltenham. Dr. Lessing suggests that the coal being moistened by steam for causing the lime to adhere to it may, by the formation of steam in the retorts, be the cause of this freedom. But Mr. Paterson gives the idea a blow by pointing to a continuous experience with dry-limed coal in a retort, the ascension-pipe of which is kept just as clear as is the case with the steam-limed coal. Conjoined is the question of the increased production of gas. This is in the main directly attributable to the coal-liming process, and not to increased temperatures. It has to be accounted for; and here again we have Dr. Lessing suggesting the formation from the steam-limed coal of a proportion of water gas. But as the moisture (and those who have inspected the coal will agree that the resulting steam must be very small in volume) must be driven off before the conditions in the retort are favourable to the formation of water gas, the idea proffered as an explanation of part of the increase of gas production per ton of coal carbonized appears but distantly feasible. However, it would be of interest and advantage in supplementing knowledge to have the idea investigated. The disappearance of the difficulty of the olden days with the coke from the limed coal is another matter that is a living fact without any present accompanying reason for the changed experience.

One of the strange aspects of these experiences at Cheltenham is that there is not one of them that was not predicted as being possible of achievement either in the early part of the century or in the 'Eighties when Cooper came on the scene. But the results then were erratic; and there were the disadvantages with the coke and the bad effects on the furnace ironwork and linings. But the results at Cheltenham are not erratic—all is secured that, and more than, was hoped for; and the disadvantages have not presented themselves in any way. What is more, the cost of the system is modest—lower, in fact, than lime purification in the ordinary manner, with the accompanying comfortable knowledge that there is no spent material that has to have quarters found for it where it will not be a nuisance to the neighbours. The figures that Mr. Paterson produced were a complete authority for the final submission of the paper. "A review of the figures given, I submit, definitely estab-"lishes the fact that not only has coal-liming removed the "stigma of sulphury gas in an economical and easily "applied manner, but that the process has brought in its "train advantages which we in Cheltenham would not "willingly forego." With the sulphur compounds at about 20·5 grains, with stopped ascension-pipes eliminated, with the make of gas (with similar coals and temperatures) at about 13,400 cubic feet per ton compared with more than 800 feet less before the advent of coal-liming in the working, and with the yield of sulphate of ammonia 1·88 lbs. per ton above the average of the previous seven years, it

cannot be denied that there is substantial benefit, and it is directly assignable to using an amount of lime equal only to 1·79 per cent. of the coal carbonized. These are hard effects that can be easily evaluated; but the more they are examined the greater is the desire to know something further of their origin. Mr. Paterson's paper is opportune; and we believe that coal-liming will, through it, be set upon its legs in those works where, with the abolition of the lime purifier, the sulphur in the gas is not quite as low as is reputable.

Carbonizing Plant at Guildford.

It was an uncommonly interesting constructional paper that Mr. P. C. Cleasby read at the meeting of the Southern Gas Association last week. For works of the size of those at Guildford, the author has put up a power worked horizontal carbonizing plant, modern in every detail, that is an exception rather than the rule; and he has done this at an inclusive price per mouthpiece, or per ton of coal, and is doing the work at a cost, that will bear comparison with any installation of comparative proportions and features. New modes of working have facilitated the realizing of economy in construction and space; and the gas engineer is not up to the mark if he misses in his constructional work any of the advantages that have accumulated from latter-day experience. Here we have eight retorts in a setting in four tiers; and these retorts have each been charged with 14 cwt. of coal by a single journey into the retort of the chain of a Fiddes-Aldridge machine, though 12 cwt. is a normal charge, and 10 cwt. when working under pressure. Looking over the hydraulic main and tar arrangements, there is foresight embodied in them in view of the fact that the retort-beds of the house will, for the seasonal service of Guildford, be variously required. The telpher system of coal and coke handling is an instance of quite up-to-date equipment; and for this apparatus and the Fiddes-Aldridge machine, there is an electricity generating plant.

An interesting and useful section of the paper is that where, for the various operations of the machinery, the author has given the approximate quantity of electricity required, and the time absorbed in the various operations. Details of this kind have not been frequently available; and as a matter of fact, there are gas-works where the electrical records are not maintained with that constancy and exactitude that are desirable for a complete register of the operations of the concern. The figures now given by Mr. Cleasby are subject to revision when he gets the coal plant running; but on present experience, he is pretty confident, notwithstanding the criticism of Mr. James W. Helps and Mr. Bernard F. Browne, as to their substantial accuracy. The energy used per ton of coal handled—including breaking, elevating, conveying, charging, and coke handling—is calculated at about 1¼ units. The cost for gas per unit of electricity is a little under ¾d. So that the cost of running per ton of coal is slightly under 1d. per ton. Mr. Cleasby does not say the price per 1000 cubic feet with which he charges himself for the gas-engine driving the electrical plant. Labour charges, per ton of coal carbonized, under Guildford circumstances, and for horizontal working, are also low. Many a large works would like to be in the same street with Mr. Cleasby in this respect.

There were two points in the discussion that were of especial interest. The first was the charge raised (in a letter) by Mr. J. Ferguson Bell as to the single ascension-pipe per retort being responsible for a greater production of carbon disulphide than ascension-pipes at both ends of a retort. Confirmation was given by Mr. J. W. Morrison, of Sheffield, in a communication to Mr. Bell, and by Mr. Helps in the course of the discussion. The second point was that raised in the "Journal" last week as to the effect upon incandescent coke of immersion in a deep water-tank for quenching, as practised in the telpher system. This was freely commented upon. Experience and observation appear to differ; but the fact remains that in some places modifications are being made so that the treatment of the coke shall be less drastic. Incidentally, the telpher system of handling the material of a gas-works is growing largely in favour; and it is strongly contending with the older systems of transmission for superiority on the ground of an over-all economy. But this has yet to be proved. It may turn out that the telpher and other systems of works' transport will each continue to have its place, under various conditions, in the economy of gas-manufacturing operations in this country.

Some Gas-Engine Phenomena.

It must be admitted that, among those whose business it is to supply town gas for power purposes, there are various phenomena associated with the gas-engine that are very imperfectly understood. The reason is that their interest has been largely concentrated on the triple aspects of supply, mechanical characteristics, and general working efficiency; while the phenomena that underlie the interests they more immediately hold in relation to the gas-engine have been left severely to those whose business it is to make gas-engines, and to investigators, like Professor F. W. Burstall, M.A., of Birmingham University, who have made a speciality of research in the ever-fascinating field supplied by the internal combustion engine. Tome upon tome have been written on both phenomena and theoretical considerations; and those, with many other interests also claiming attention, who have made a study of some of these volumes to get an inner knowledge of matters that do not directly concern them in the everyday working of gas-engines have found so much, from different minds and researches, that appear at variance that they have wished, and that profoundly, that someone with the necessary qualifications would serve up for them a digest free from abstruseness. We are talking of the phenomena and scientific fundamentals connected with the gas-engine, and not of the purely technical details, treating of which there are several handy text-books of varying quality.

For these reasons, we have read with pleasure the abstract of the lecture on the "Production of Power from Gases," delivered last week by Professor Burstall—being the first of a series of six—to the Midland Junior Gas Association, under the auspices of the (senior) Midland Association. The lecturer did not treat his audience as being ignorant of gas-engine design and practical working; but some of the phenomena that to scientific investigators are now merely a form of original elementary problems were very likely then for the first time placed before the Midland juniors in simplified language that the man with practical knowledge of the gas engine could readily understand. Combustion, temperatures, cycles, governing, and other matters, were discussed. There was one thing amid it all that was very apparent—that is, that finality, with all past research, has not as yet been reached in the improvement of the gas-engine. Most advances are accompanied by some drawback of more or less importance in degree. For example, in quality governing, which is the practice now generally adopted by engine makers, there is the difficulty of an occasional weakening of the charge to an extent that the spark will not, or rather cannot, ignite it. It is not a difficulty of a serious character—in fact, Professor Burstall only refers to it as a "slight drawback." But while even "slight drawbacks" of the kind are found to exist, there is remedial work to be done.

Among practical questions treated by Professor Burstall, he supplied data as to differences in constitution, thermal values, and other matters of town gas, coke-oven gas, and suction, producer, and blast-furnace gases. The data for the suction, producer, and blast-furnace gases may be taken as representative; but they do not exemplify the point as to the considerable variation that takes place in the quality of such gases in the same plant under everyday working conditions. Professor Burstall, however, does not ignore the defect. He has no interests to serve other than those of Science. In almost every case he points out, an engine on suction gas is furnished with a larger cylinder for a given power than for ordinary gas—the reason being that "the unhappy suction-gas producer is in the habit of tiring at the end of the day's work, and hence you must make allowance, and have a good margin. On town gas, you can secure constant heating value all day, year in and year out." Then further to the good character of town gas for gas-engine purposes, he deals with the liability to premature ignition through the use of unclean gas; and therefore cleanliness of gas is absolutely essential. "Town gas has always been clean; and when you come to producer and blast-furnace gas, the same conditions do not apply. . . . It is not unfair to say that many of the difficulties of gas-engines on producer gas have been because the gas was not sufficiently clean." In connection with the point of relative values, we wish our friends of the universities would adopt uniformity of terminology. In one table, Professor Burstall gives the heating values in calories per cubic metre; while in the lecture itself, he expresses the heating value in

British thermal units per cubic foot. Conversion is not a difficult matter; but why put several people to the trouble of converting figures, when one person in the first instance could do it for them all? Our own British terms, until, if ever, they are disestablished, are quite good enough for general use; but anyway let us not fall into the employment of dissimilar terms in a single lecture.

Continental Experiences.

THE address delivered by Mr. J. Horsley Palmer to the proprietors of the Imperial Continental Gas Association last Tuesday, was in large part compounded of several points that possess, in greater or less degree, the character of novelty. A common experience, and not a matter of novelty, for the first half of this year, among gas undertakings at home as well as on the Continent, is an increase in consumption on such lines as 6½ per cent., and an extension of the connections on the lines of 7¾ per cent. Had the last half year not been a mild one, these figures in the case of the Association, it is confidently believed, would have been on a still higher scale. Now if there is a country where electricity has been driven for all it is worth, but where scientific investigation has assisted in controlling the opposing commercial interests, that country is Germany. And both the gas and electricity industries there progress. It is claimed by some electricians at home that they are now wresting from the gas industry the lighting business at a remarkable rate. The gas industry knows full well that this is untrue; and the accounts of most electricity undertakings nowadays show that the major part of their new business is in connection with power uses—principally by the supplanting by electric motors of steam boilers and engines. Electricity consumers, too, are frequently returning to the use of gas for lighting, in addition to its consumption for other purposes.

In this country, we have some difficulty in discriminating between consumption for one purpose and another, owing to the prevalence of flat-rates for all purposes. In consequence of this, we can only judge as to how things are going by the hour-to-hour registration of the output of the works. It is therefore interesting to learn that, notwithstanding keen competition, and the expanding use of the more economical gas-burners, the Imperial Continental Gas Association, operating in many places, had an increase last half year of 3 per cent. in its consumption for lighting purposes; and 3 per cent. with them means a considerable volume of gas. A still more notable figure is the 8 per cent. increase in the daylight consumption, which represents domestic heating and industrial business. In this direction, there is a vast field for development, as the domestic heating business, through various conditions that do not obtain in this country, has not shown so much vitality in Germany and France as here. In this very fact, there is the assurance of an enlarging prosperity for our gas friends operating on the Continent. Relative to this question of competition, one way in which the Directors of the Association have evidenced their politic government has been by taking steps to obtain financial interest, at certain stations, in the undertakings of their competitors; and they are thus able to have a voice in the control of these concerns. Here the position is altogether different, owing to the majority of the electric undertakings being under municipal management.

Another point that is somewhat unique was referred to by the Chairman. It is not a general experience that a torrid summer is the direct cause of a big rush for the coke stocks of gas-works. But it was so in North Germany this year. Owing to the heat, the waterways which afford the cheapest transit for coal and coke were so far depleted of water, that fuel deliveries were made into the large cities at very sluggish rate; and, in consequence the local merchants, in their own protection, fearing that a severe winter was in sight with a shortage of fuel in their own stores, bought up gas-works coke stocks in large quantities. We have heard of the magnificent harvest enjoyed during the past summer by mineral water makers and retailers, but little thought, while suffering the heat of those days, that they were assisting in giving relief to the Imperial Continental Gas Association from a somewhat ugly coke stock. From the most unexpected quarters friendly aid sometimes comes along. These very waterways are those that in severe winters prevent the regular delivery of coals into gas-works of North Germany. They operated in much the same way during the heat of the past summer; but they offered the compensation to which we have referred.

Manchester Smoke Abatement Exhibition.

REFLECTING upon the magnificent advances of the social and economic conditions of the world, there is one thing that must forcibly strike the thinker, and that is the extensive survival of barbarous waste in our modes of heating. Nature's chief fuel, with all its wealth of valuable constituents, is ruthlessly consumed for the one object of obtaining heat; and this in a manner that causes large dissipation of the heat, as well as an entire sacrifice of the remaining contents of the raw material. This both applies to the domestic hearth and to many of the furnaces of industry. In opposing such waste, there is not an industry that is more capable, and that has larger opportunities, than that of gas supply to work to the end of an economical and profitable use of Nature's supply of raw material, by rescuing from it, by the disunion of its constituents, those parts that are each and every one serviceable to mankind. Never in its whole history has the gas industry been in such a position as it is to-day to economically render this service in the cause of progress and to its own advantage; and everything that the industry is doing is directed to the better shaping of its processes to this end. Not only (we say this not for technical readers, but for gas administrators) is there direct waste by the present methods of using coal for the production of heat, but those methods contribute largely to an insanitary and unhealthy condition of the atmosphere of our towns, causing dirt and contributing to ill-health, and thus again producing waste of money and human energy. Growing gas-works economies and the consumption of the primary product are contributing to lower prices for the latter; and the more business that is done, the more sure is it that gas prices will descend generally—in municipal towns, providing that the gas undertakings are not, as Mr. J. G. Newbigging says in an article in the official catalogue of the Smoke Abatement Exhibition now being held in Manchester, "unduly handicapped by being called upon to "contribute excessive sums in aid of the rates." With a reservation as to the heavy appropriations from gas profits in aid of the rates, the Manchester Corporation are doing a good part in working for the improvement—and it needs improvement—of the atmosphere of this great industrial centre by offering facilities for the use of gaseous fuel.

Manchester and adjoining districts have given excellent encouragement to the Smoke Abatement Exhibition that is being held in the city; and we feel confident that the whole of the gas undertakings in the Lancashire and neighbouring counties will make good use of the demonstration until the doors of the City Exhibition Hall close upon it on the 25th inst. Smoke abatement exhibitions are worthy of the utmost encouragement by the gas industry; for the industry recognizes that their undertakings are now the producers and purveyors of fuel, and not of gas that should be, for economical and other reasons, alone depended upon for luminosity without ancillary appliances. In the exhibition these things are demonstrated to the public; and, moreover, the public are shown the rivals in use for all purposes—the rivals that will produce light and heat without adulterating the atmosphere by smoke. The public can choose between these claimants to economy, efficiency, and prudent method. We feel satisfied that the marvellous range of gas in all respects will maintain its lead in public favour. There is no domestic operation or purpose in, or for, which heat is required that it has not been made to serve, and in a manner that in application responds to the will of the user. Here we have in this exhibition high and low pressure lighting displayed, automatic control, cookers, fires, and appliances to meet the water requirements of the household—even to the means of lightening the work and drudgery of washing day, and of keeping the conservatory at a proper temperature when the outside atmospheric conditions menace the interior charms. The point as to gas being capable of regulation in a manner to maintain an equable temperature for any purpose, or to obtain variable temperatures for culinary use, is one that requires to be forced upon the notice of the public. They have not been accustomed to the facility of heat regulation; and its convenience and value are overlooked. In exhibitions of this kind, there is, it seems to us, too great a tendency on the part of our well-intentioned makers of gas appliances to advertise their goods by impressing the public with the intensity of their heating capabilities. There are other points that also need impressing. The gas and electric houses at the exhibition are popular features. Among the smokeless solid fuel here on view is

"Coalexld," of which gas undertakings, using the simple process, are producers. The idea of differential gas prices for heating is brought before us by the discount meter; and certain features of the latest developments in carbonizing are illustrated to the technical gas man by the Woodall-Duckham exhibit.

All must regret that Alderman R. Gibson, the veteran municipal gas politician and progressive, was not spared to see the exhibition, in which but a few weeks since he was taking such a live interest. But his successor in the chair of the Manchester Gas Committee (Mr. Councillor Kay), the members of the Committee themselves, Mr. Newbigging, and the friends of the gas industry in Salford and elsewhere in the district, have done their part in not only encouraging the organizers, but in making known the attractions. The advertisement pages of the local Press are not neglected; leading papers in Manchester will have gas topics bulking largely in them in the current fortnight; and admission tickets have been distributed by the gas undertakings in the district. We wish the exhibition an abundant success. We believe that most, if not all, the members of the Institution of Gas Engineers have received admission tickets; and a day and evening at the Manchester Exhibition, by those who can conveniently visit the city, will not be ill-spent. It is understood that the Manchester Institution Commercial Sections are informally paying a visit to-day.

The "Daily Telegraph" Engineering Correspondent's Reply.

We have received the article from the Engineering Correspondent of the "Daily Telegraph" that he promised to contribute to our columns, under certain peculiar conditions (*ante*, p. 253); and the proof is in his hands for revision. It will be remembered that he stipulated that the article should be published within fourteen days of its receipt. It will be published next Tuesday. He also stipulated, for some recondite reason, that we should abstain from editorial comment on the article for a week from its publication. Our comment will appear next Tuesday week. At the same time, or subsequently, any of our readers who desire to show our friend some of the errors of his ways and of his recent writings on the subject of gas and electricity will be able to do so in these columns.

"Terrible Gas Explosion" in Glasgow.

This was the heading to a report in a London paper last Saturday morning; and with it were united the gruesome intelligence that "three people were buried" and "others killed and injured." Though the heading was definite as to the cause of the explosion, in the account of the disaster it was stated that "it is officially reported that a gas explosion is believed to have occurred." Then followed the further suggestive statement: "There is no engine in the store, but the premises are illuminated by gas." The scene of this catastrophe on Friday night was the Glasgow flour-mills of Messrs. William Primrose and Sons, Limited; and on making an inquiry for authentic particulars on Saturday, a reply was received "Explosion in flour mill due to dust. Workers report that no smell of gas noticed." The Glasgow papers confirm this view, as will be seen by a report elsewhere. So much for a disaster that has far and wide been, in more or less categorical terms, attributed to gas.

Meat Waste in Cooking

We have for some time past been hammering away at the specious arguments and statements of people with electrical kitchen appliances for sale, and have been trying to obtain from them some account of the character of the comparative tests that they suggest have been made by them in connection with both gas and electricity. But our efforts are not rewarded from the other side. Among other things we heard a lot about the greater wastage of meat in cooking by gas than in cooking by electricity through the alleged better retention of the juices of the meat in an electrically cooked joint than in one gas cooked. We like a juicy piece of meat ourselves; and it can be obtained if the gas-oven is properly treated—by raising the temperature of the oven (before putting the meat into it) to a sufficient degree to rapidly seal the outside of the joint, and by utilizing that much neglected precaution of having a little water placed in the bottom of the oven. We learn from a lady cookery demonstrator at one of our technical institutions that this precaution has been taught for many years past by her, but she is afraid that, so careless are people of household economies, that it is more honoured in the breach than in the observance by consumers. But touching the difference in the weight of joints before and after being cooked. The weight, after cooking, is not much to go by to indicate the proportion of solid meat—seeing that the greater the liquid contents of the joint after being cooked, the greater will be the escape of the juices into the dish immediately the carving knife and fork come into operation. To get to the proper and relative weights after cooking, the meat and the juices that have escaped during the process should be weighed together. It is quite obvious that the weight of a cooked joint does not necessarily represent all solid meat.

And Cookery Costs.

As to the question of relative costs, there have been some interesting figures lately put forward by our electrical friends, which suggest that electricity has suddenly been invested with a greater thermal value than calorimetric tests give it credit for; or, at any rate, what it lacks in this way is compensated by greater ingenuity on the part of the modern makers of electrical appliances than on the part of the long-experienced makers of gas appliances. We know that electricity purveyors are anxious to get a footing in the culinary work of a household; but it looks much as though they will in the long-run do themselves an immense amount of harm by misrepresentation. It has been going the round lately from electrical sources that the costs of cooking and water heating by electricity are on a level, or at most are but a shade higher, than the costs of doing the same work by gas. Mr. Harold Gray, in a recently published paper, made it appear that the average cost of the operation of an electric-oven is not more than that of a gas-oven; and this and other points have been tackled by the Davis Gas-Stove Company, Limited, who have produced some temperature readings and costs from actual comparative tests that will suggest to our electrical friends the need for further investigation on their side. These figures will be found in our "Miscellaneous News" columns (p. 481). Supplementing them are others towards the end of the review of a book on the advances of gas lighting during last year, which has been compiled at the instance of the Association of Gas and Water Engineers of Austria-Hungary. For this book the gifted Professor Strache, Professor at the Technical College at Vienna, is responsible. The comparative costs given there for cooking and heating by gas and electricity are also instructive. But generally the subject is one that our gas-stove makers ought to publicly take up with a little more vigour than has hitherto been the case. We urged them to action in an editorial article that appeared in our issue for Oct. 10; but there have not yet been many outward signs of activity. The corpulent character of their business is no excuse for ignoring those who are attempting to attack it in a manner that suggests hatred, malice, and all uncharitableness.

The Other Side of Municipal Trading.

Some correspondence which has appeared in a Plymouth newspaper suggests a view of municipal trading which is not always apparent to the enthusiasts who gloat over the progress made by corporation gas and electricity and other large undertakings. It began with a letter from an anonymous "Worker," who was annoyed by the shortcomings of the Devonport municipally-owned gas-works, which had, he alleged, taken some five weeks to execute an order for the supply and fitting-up of a gas-cooker in his house. Whether the gas management was really as slow as the complainer made out, and what excuse there was for the delay, if delay there was, does not appear. Probably the Gas Committee have a sufficient answer if they cared to make it; and certainly they are not likely to be greatly moved by "Worker's" suggestion that they should be stirred to greater activity by keener competition on the part of the electricity undertaking, which is also municipally owned. The time is not yet (if it is ever going to be) when, even with free wiring and free cookers, electricity is to be a serious rival to gas in the working man's kitchen. The complaint has, however, drawn from a tradesman in the town a striking presentation of the case as it appears to the ironmonger or plumber, who sees in the growth of municipal activity something which threatens his very means of existence. "Worker," he says in effect, need not

have waited five weeks or five days for his cooker if he had gone to a trader; but, of course, he did not do so because the trader would want paying for the cooker and the labour of fixing it. No one, he adds, will blame a man for going where he can get a cooker supplied and fixed for nothing; but what about the trader, who very possibly is employing a member of "Worker's" own family? "Tradesmen are expected to be first and foremost in anything that is going on in the borough, to contribute to this and that. . . . Tradesmen all through the country appear to be the first for everything. When there are riots in a town, his fellow-townsmen generally mark the tradesmen's windows. He feels depression of trade, but must find his rates all the same, while 'Worker' receives his full wages, and while spending his money with municipal traders he helps further to depress trade by giving his orders away from those who pay so heavily towards the rates." The reply to the ironmongers and plumbers is, of course, that the business of supplying gas stoves and cookers is not one which they have lost, because they never really had it. As compared with the trade which has grown up under the stimulus of the prepayment meter and the hiring system adopted by gas companies and corporations, ironmongers and plumbers never did more than an infinitesimal amount of business. Nevertheless, there is some excuse for the bitterness of the tradesman who feels, when he is paying his rates, that he is indirectly, if not directly, contributing towards the support of a powerful rival in a branch of business which would be profitable if he could get it.

Negotiations to be Continued.

A decision which it is hoped will go far to lessen the chances of a general coal strike was come to at a meeting of the Conciliation Board for the federated districts of England and North Wales which was held in London last Friday. This was to the effect that the negotiations on the question of a minimum wage shall be continued, and that a further conference shall take place on the 6th prox. This agreement should have an important bearing on the national miners' conference, which had previously been fixed for to-day, for the purpose of determining the action of the men on the question. Friday's meeting, it may be pointed out, followed sectional meetings in each of the districts included in the Conciliation Board's area. At these, the owners had declined to agree to the principle of the payment of a fixed minimum wage for every man working at contract rates irrespective of his disposition or ability to earn it; but in some districts the owners had expressed their willingness to meet the men by setting up machinery to investigate all cases in which workmen complained that they had been unable to earn the average wage by reason of faults in the coal-seam, &c. South Wales and Scotland have still to be reckoned with.

Operation of a Slow Sand Filtration Plant.—The last annual report of Mr. Otis F. Clapp, the City Engineer of Providence, furnishes some of the results of the working of the slow sand filtration plant there. The water is drawn from the Pawtucket River, and is passed through ten covered slow sand filters, each measuring 174 ft. by 250 ft. in plan. The total quantity of water filtered during the year 1910 was 5,806,942,000 gallons, or an average of 1,729,000 gallons per acre daily. The ten beds were scraped 180 times, and were in service 80,582 hours. The maximum length of run was 84·3 days; the minimum, 6 days; and the average, 18·8 days. On the average, 33,772,000 gallons of water were filtered per acre between the scrapings. The water contained during the year from 1060 to 7000 bacteria per cubic centimetre, based upon the monthly averages. In the filtered water, the average bacterial content was 41; giving a percentage removal of 98·3. The cost of filtration per million gallons is given as $4.98, including $3.20 for pumping.

A "Gas Department Magazine" for Birmingham.—We learn from a circular just to hand that it is intended to commence early next year the publication of a monthly magazine in connection with the Gas Department of the Birmingham Corporation. It will be edited by Mr. E. W. Smith, M.Sc., of the High-Pressure Gas Laboratory of the Corporation, in association with an Editorial Committee. Their aim will be to make the magazine attractive, useful, and entertaining to every employee in the department, and enable each section to take a livelier interest in the doings of the other sections. A large proportion of the magazine will be devoted to accounts of the work of the various clubs and societies connected with the works and the Council House. There will also be published technical information of a nature useful to fitters and others interested in the making and uses of gas. The cost will be 2d. The quality of Mr. Smith's work, in his capacity of Research Chemist to the Gas Heating Research Committee of the Institution of Gas Engineers is well known to most of our readers.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 476.)

THE week just closed on the Stock Exchange was not a brilliant one. Business was at low pressure, checked in some measure by its being account week. But the settlement was apparently adjusted without difficulty. Movements were irregular. Consols, which had been doing so well, had a decided set-back, actuated by various factors. Railways made some brave attempts at cheerfulness; but apprehension in regard to labour was the dominant influence. The Foreign Market was, however, quite strong, in spite of wars and rumours of wars; and several industrial lines were buoyant. The opening day was quiet, and the tone was patchy and uneven. Gilt-edged things and Americans were about the best. Rails were lower on the labour leaders' decision to go for a ballot. Tuesday was quite dull and inactive. Government stocks were weak, and Consols fell $\frac{5}{16}$. Rails had a further fall, but looked like steadying before the close. Wednesday was a bit better, but still with some weak points. Consols were lower. Rails improved during the day; and the Foreign Market was firm, except for Chinese. Some markets were cheerful on Thursday, with rising prices; but Government issues were not among them. Consols fell another $\frac{1}{8}$. Rails rose and then fell again; but Americans and Foreign were firm. Business was poor on Friday, and the tone was decidedly flat—sales depressing prices. The gilt-edged division and Rails were quite weak; Americans closed below the best; and Foreign were only middling. Saturday was unimportant, and markets were somewhat unsteady and inclined to see-saw. Consols closed at 78⅜ to 78⅛—showing a loss of $\frac{5}{8}$ in the week. The Money Market was quite easy at first; but the rates gradually hardened and closed firm. Business in the Gas Market was, as a whole, quieter than the preceding week, especially in the larger and more important undertakings. But there was no diminution of strength, and several issues made further advances in quotation. In Gaslight and Coke, the ordinary was fairly busy, and clung doggedly to the old prices it established some weeks ago—viz., 104¼ to 105—with rather a disposition towards the close to advance upon these. In the secured issues, the maximum realized from 85 free to 86⅜, the preference from 103 to 104, and the debenture from 81 to 82. South Metropolitan was quiet and firm, changing hands at 116 to 116¾. In Commercials, the only business was a couple of deals in the 4 per cent. at 110½ and 111½. Among the Suburban and Provincial group, Alliance and Dublin was marked at 79 and 80, Bournemouth "B" at 16⅜, Brentford old at 258, ditto new at 199 and 202 on the London Market. On the Liverpool Exchange, the local "A" stock was done at 220 (a rise of 1), and the "B" at 165. On the Sheffield Exchange, Sheffield "C" fetched 239½ for an odd lot. In the Continental companies, Imperial realized from 186 to 189 *cum div.*, and 183¾ to 185 *ex div.*, Union 90, and European from 19¾ to 20 1/16—a rise of ¼. Among the undertakings of the remoter world, Bombay was done at 6¼ to 6½, Cape Town at 2⅜, ditto debenture at 82, Hong Kong at 17¼, Monte Video at 12¼ *ex div.*, Primitiva at 7⅛ and 7 1/16, ditto preference at 5¼ to 5 11/32, and River Plate debenture at 96.

ELECTRICITY SUPPLY MEMORANDA.

Local Exhibitions—Subtle Publicity Effort—Electricity and Fire Precautions—Fire Insurance and Electricity—Mill Lighting—Meter-Rents and Charges at Brighton—Points from Marylebone—Mantle Efficiency.

THE electrical industry is operating in grim earnest to get all the publicity it can before the British Commercial Gas Association start systematically to work. Short-time local exhibitions, with popular lectures by oleaginous-tongued gentlemen, have been, and are being, held in several places, and the local newspapers report that they are doing an immense amount of good for the electricity undertakings for whose special behoof they are being run. As a booster of business among the public, the exhibition at Olympia was a confessed failure, through various reasons; and the local show on the small scale is now trying to improve the fortunes of the electricity supply industry. There is an epidemic of these. The Electricity Publicity Committee are also doing their best (as was shown in an editorial paragraph last week) to get the circulators of popular news and tit-bits to take an interest in the commercial affairs of the electricity industry. The means that they have adopted is the free advertisement one. If they can get advertisement without payment, it is to the credit of their methods. Through an agent in the neighbourhood of Fleet Street, the Publicity Committee send broadcast among the London and Provincial newspapers a sheet containing what are considered to be items of public interest in connection with the electricity industry; and the editors are invited to make what use they like of them. A good many editors do not make any use of the items. They perceive in the news sheet the gentlemen who want something for nothing; and the sheet goes, in such cases, into the waste-paper basket. There may, however, be other editors who read the items; and are favourably impressed with some of them. The British Commercial Gas Association will have to see that editors of the London and Provincial Press get bestowed upon them a share of the new educational effort of the gas industry.

The satirical electrical gentlemen who refer to electricity as the

"safest" illuminating agent have found that the public that at one period was disposed to take them seriously has for some time past exhibited a decided tendency to treat them contemptuously. The experience and reports of fires due to electrical causes, and the reports of the sums of money that certain of these fires have cost the insurance companies, have educated the public in a way that the sophisticated literature of electrical origin cannot possibly wipe out. Consulting our memory, too, there are, within experience, certain large users of electricity upon whom the ever-hidden fire risk of electricity has been impressed immediately succeeding the installation of the electric lighting system by the prompt appearance of the agent for some special form of fire extinguisher, as though the latter were a well-recognized and necessary adjunct of an electric light installation. At the electricity exhibition at Olympia, fire extinguishing appliances were also quite a noticeable feature of the display. We turn from these evidences of public recognition of a well-attested fact to the columns of an electrical contemporary, which informs us that the winter session of the British Fire Prevention Committee commenced the other day with a meeting "to conduct a series of fire tests dealing with a small hand extinguisher, intended to put out electrical and petrol fires." The electrical industry ought to hold classes for instructing electricity users in good markmanship at exciting moments.

This question of insurance was recently touched upon by a "Practical Engineer" in an article on "The Lighting of Mills" in the "Manchester Courier." He remarked: "It was said by the advocates of electric lighting when they were first introducing the system for mill lighting, that lower insurance costs would be obtained. We believe that for a short time this was so; but we know that at the present time, no allowance whatever is made—in fact, it has come to be recognized that, unless the electric installation is fitted up in a very careful manner, it is more dangerous than gas lighting." Time is crowned by truth. A lecture by Mr. W. R. M'Nab, of the Guardian Assurance Company, arrests our attention. Mr. M'Nab delivered his soul at the Electrical Exhibition at Dublin; and he was careful not to say that electricity was the safest of illuminants. He steered a middle course. "Although no system of lighting is quite free from hazard, special features of hazard occur in most classes which are not present in electric lighting. On the other hand, in electric lighting, features are present which do not appear in the other systems." That is so; and bad ones they are, too. Mr. M'Nab proceeds to say that electric lighting receives special consideration by insurance companies when used in connection with drapery risks, furniture dealers' shops, corn and flax mills, &c." Further, "there can be no doubt that there has been considerable increase of electrical hazard in recent years, due to the increased employment of electricity for power purposes, which requires the use of energy on a scale unknown in days gone by." We may quote the concluding sentences of a report of Mr. M'Nab's lecture:

> The dangers of electrical installation were now more recognized by engineers; and every care was taken to avoid fire risk, and also better systems of wiring were adopted. From the fire insurance point of view, it was a great pity that there were no means of ascertaining the qualifications of an individual styling himself an electrical engineer. Jobbers were principally responsible for cut contacts and inefficient work, wherein lay the principal danger of electrical installation from the fire insurance point of view. Another danger arose from the men in charge of electrical installations; but that was a matter which was under the control of all electrical consumers. The future attitude of insurance companies towards electric lighting installations would depend upon the attention paid by engineers and consumers to the facts which would go to reduce the fire hazard to a minimum. He concluded by asking consumers of electricity and intending consumers to bear in mind that, in having electricity installed on their premises, the following were essential: Good material, good workmanship, and good supervision.

We wonder whether electrical people will consider Mr. M'Nab's lecture a good advertisement for the (according to the fiction of electricians) safest of all illuminating agents.

The reference in the foregoing paragraph to the article on mill lighting is not sufficient, in view of the facts that the writer is a "Practical Engineer," and that he speaks from his own experience. He refers to incandescent lighting as being pleasant to the eyes of the workers, and that it enables them to see the work in progress practically without eye strain. In contrast with flat-flame gas lighting, he also praises the incandescent system from the health point of view, stating that it renders the task of ventilating rooms very much easier. Facility of manipulation is on the side of electric lighting; but through the pilot gas-jet and various practical systems of ignition and extinction, the advantage is considerably reduced. As to cost, incandescent gas lighting is cheaper. "Practical Engineer" believes that the light of the future lies between high-pressure gas and electricity. But there again his experience leads him to say that high-pressure gas is so highly diffused that there are no shadows cast as in the case of electric lighting. In his practice, he has found it necessary to use seven electric lights in the same space as five high-pressure lights. His impression is that high-pressure gas-lamps are worse than electricity in respect of the effect upon the atmosphere; but he does not take into account the aid that the heat of the lamps can be in the matter of ventilation by the most simple means. When comparison is made of the cost of installation and upkeep, all the advantages lie with the high-pressure gas system. In a series of estimates recently received for lighting a mill, the cost per light for the electric installation was almost twice that for the gas installation; and the guarantees of cost of lighting and upkeep were almost as greatly in favour of the gas system. In summarizing the comparisons, experience teaches us, he says, "that the quality of the high-pressure gas-light is far superior for working purposes than the electric light; that its cost of installation and upkeep are much less; that it requires more attention when lighting up; that it costs much less per burning hour; and that we should instal it in preference to any other system under almost all conditions we know of, except in cases where the power in use for driving purposes is electricity, generated on the premises, when there is generally sufficient margin in the plant to provide the lighting. In such a case, the added installation costs are much reduced, and the engineer in charge of the electric plant can attend to the lighting." We like such experience from practical engineers.

Brighton has had various changes in the matter of charging the electricity consumers; and it finds it difficult to get on to a settled basis. It is the birth place of the maximum-demand system; but this method of charging found little honour in its own country. It was abandoned, excepting in those cases where the consumers had a taste for abstruse arithmetical calculations, and preferred to adhere to it. It will be remembered that the author of this process of charging was Mr. Arthur Wright, the predecessor of Mr. John Christie, the Borough Electrical Engineer. That Mr. Wright does not think that finality has yet been reached in the matter of charging for electricity was divulged in the Presidential Address last July of Mr. Christie to the Incorporated Municipal Electrical Association. The latter gentleman said the former had put forward the belief "that we might ultimately come to a fixed charge per square foot of floor area, on the basis of a given number of watts per square foot, have no meters, and allow the consumers to use the supply for any purpose without restriction." A few comments on this peculiar idea were made in the "Memoranda" for July 11 last; and we will not repeat them. Now Mr. Christie has proposed that meter-rents should be abolished, excepting where the maximum demand is the method of payment; but the Borough Accountant has called attention to the fact that this would mean a loss of £1200 a year from the revenue, and that, while meters for new consumers would have to be provided in future, there would be no return in the way of meter-rental. Abolition has not found favour with the Council. It may interest our electrical friends to know that, after several years' trial, the Gaslight and Coke Company reverted to meter-rents, in order that those consumers who merely had meters connected for stand-by purposes and occasional use (such as in offices) might have the opportunity of doing the right thing, by paying something for them and the convenience. The Company found that a much more wholesome way of making concession was through the price of gas. However, the Brighton Corporation, it appears to be clear, have reduced the price of current to 1d. per unit for power, heating, and cooking, where not less than six 16-candle power electric lamps are also used.

Alderman E. Debenham, the Mayor of Marylebone, reviewed the work of the Council at a recent meeting; and in the course of it he gave utterance to a lengthy panegyric on the work of the Electricity Supply Department. The words must have tingled pleasantly in the ears of the Committee and officials. There are one or two points that call for comment. His Worship referred to the completion of the work of converting the lighting of the street lamps from gas to electricity, and claimed a saving to the rates of about £1500 per annum. We think Alderman Debenham was not doing his business qualifications justice when he said this, because his comparison was made with the conditions that existed at the time the conversion scheme commenced, and not with the conditions as they exist now. Since the change-over was decided upon, the price of gas has been considerably reduced; and high efficiency inverted gas-lamps have come upon the scene for street-lighting purposes. Other boroughs have taken advantage of these altered conditions; Marylebone has not. Alderman Debenham should show the ratepayers the position between existing conditions—not the existing condition of electric lighting with current at a price per unit considerably below what the electricity consumer has to pay, and a past condition of gas lighting under an old contract. He will see the fairness of our point. Another remark that he ventured on shows that the "telephone" system of charging has not converted all the consumers from the old bases of payment. He stated that it is proposed to offer an alternative to the maximum demand system of a sixpenny flat-rate to all consumers; and therefore 1930 consumers who are at present paying more than 6d. per unit will have "a welcome reduction" in their accounts. The cost to the Department will be some £1800. He also defended the Sales Department; and dealt with the attacks of those who accuse the department with unfair competition with the local electrical contractors. Later in the meeting it was resolved that the Electric Supply Committee should be instructed to report on the advisability or otherwise of continuing the Sales and Publicity Department on the present lines, particularly having regard to the questions raised by the Electrical Contractors' Association. Has anyone any doubt as to his competence in making a fair prediction as to the resulting main finding?

"Meteor" of the "Electrical Times" claims to be an expert on gas-lighting matters, as well as electrical; and therefore we desire to put to him a few questions. The first is as to whether it is impossible to keep an inverted gas burner and mantle up to a high state of efficiency? This question is a plain one; and we do not want to hear anything about what some careless and negligent people do. We have found some careless and negligent people who

have kept electric lamps in use when they ought to have been in the dust bin. So, instead of running off on side-issues, let us have an unadulterated reply to a plain inquiry. The second question is, whether there are any of the vital parts of an inverted burner which deteriorate in any manner that affects the efficiency of the mantle? If so, which are they? The third inquiry is, with an inverted burner fitted with a needle regulator which can be operated at will (though wide intervals suffice), and which governs the supply of gas to the flame, is there anything of importance that can injure flame temperature in any degree sufficient to seriously affect the illuminating power of the inverted mantle? If so, what is it? Coming to the fourth question, bearing in mind that a good mantle is made under a far higher flame temperature and at a higher gas pressure than under normal conditions of use, bearing in mind too that the structure of a mantle consists of thorium and ceria, is there anything in the composition of the structure that can sensibly deteriorate by the action of the flame, and that will sensibly depreciate the illuminating value of the mantle? We particularly want "Meteor" to answer these questions, because if it is possible (and we know it is, by the exercise of very occasional attention to the burner-regulator) to maintain a light of 25 candles per cubic foot of gas consumed per hour with an inverted burner, then the gas industry offers a light to the householder against which the metallic filament lamp, at commercial prices for electricity, cannot compete.

If it is possible to maintain the high mantle efficiency, then some of the most lamentably foolish assertion on this question is written in the electrical technical press. If it is impossible to maintain the high efficiency, then, by answering our questions, "Meteor" will, of course, show us wherein are the factors that make for the impossibility. Here are two extracts from a recent note by him:

A gas-burner may have an efficiency of 25 candles per cubic foot when it is new, and is properly adjusted and protected, and is being fed with rich gas at a pressure regulated to give the best results. But when it comes to be put into actual service, may not the combined effects of corrosion, mantle deterioration, variations of pressure, and the other ills to which gas-burners are heir, reduce the efficiency to such an extent that over its useful life the initial efficiency needs a multiplier of ·25? . . . Gas-mantle efficiency is an elusive quantity; the actual workaday average is so miserable a drop from the initial efficiency obtained under laboratory conditions that the advocates of gas never dare to give the public an inkling of the discrepancy.

The tortuous process of our friend in decrying mantle efficiency is beautifully clear; and so we should like to fix him down to something a little more explicit by obtaining replies to the inquiries in the preceding paragraph. He talks about an incandescent burner being fed with "rich gas." Believe us, "Meteor," rich gas is one of the worst of enemies where a high temperature bunsen flame is required. He talks of laboratory conditions being something denied to the domestic consumer. The same gas, the same burners, the same mantles are supplied to the laboratory as to the domestic user. "Meteor" should try to shield himself from external doubts as to his intelligence on certain subjects affecting gas lighting affairs in a manner better than he has done on this occasion.

PERSONAL.

Mr. JOHN A. ROBERTSON, Gas Manager at Polmont, has been appointed to a similar position at Lockerbie, in place of the late Mr. Cowie.

Mr. ROBERT JAMES PHILP, who has been on the staff of the Dunfermline Corporation Gas-Works for six years, first in the capacity of Distributing Superintendent, and latterly as Assistant Manager, has been appointed Manager of the Polmont Gas-Works.

Mr. J. W. BROWN, the Manager of the Chapel Whaley and District Gas Company, who (as was mentioned last week) has been appointed Manager for the time being to the South African Lighting Association—during Mr. Arnott's absence from the Cape—is to leave this country on the 9th prox. Mr. Brown has only been at Chapel-en-le-Frith for fourteen months, during which time nine miles of mains have been laid, over 500 new consumers added, and orders are in hand for over 400 more. A spiral-guided holder and new purifiers have also been erected. The make of gas has increased from 5½ million cubic feet to close upon 10 millions. In consideration of the extra work Mr. Brown has undertaken, the Directors granted him an honorarium of £15, and received his resignation with "great regret."

Mr. J. W. Brown, of the Chapel Whaley and District Gas Company, is succeeded by Mr. EUGENE MEUNIER, son of Mr. S. Meunier, of Stockport, and Assistant to Mr. H. Kendrick, of Stretford; and he left on Saturday to take up his duties. As a mark of esteem, the employees, a few days before his departure, presented him with a handsome kit bag, and expressed their best wishes for his success in his new position. Mr. Meunier, who is in his twenty-ninth year, served his time with his father at Stockport, and was with Mr. Kendrick for about six years—first as Chemist and afterwards as Assistant. Mr. JAMES BRIDGE, who for the past three years has been Works Chemist, will fill the position vacated by Mr. Meunier, but will retain his control over the laboratory; and Mr. WALLACE SUGDEN has been appointed laboratory assistant.

A RUNAWAY PLAINTIFF.

The Recent Libel Action against the "Journal."

LAST week's number of "Truth" refers at length to the action for libel recently brought against the "JOURNAL." Under the heading of "A Runaway Plaintiff," the following remarks by "Scrutator" appear.

A moral frequently drawn in "Truth" has once more found illustration in the Law Courts. On Oct. 27, before Mr. Justice Bucknill, a libel action against the "JOURNAL OF GAS LIGHTING" was in the list for hearing. The plaintiff was one Louis Dosteel, who traded at 2, Gray's Inn Road as the Incandescent Supply Syndicate. This was a home employment business, by which, on representations that they could earn £3 a week by making incandescent gas-mantles, people were deluded into paying between £2 and £3 to Dosteel for an outfit. The business was a palpably dishonest one; and the Syndicate's operations earned for it a place in "'Truth' Cautionary List." Dosteel took no notice of my criticism; but when the "JOURNAL OF GAS LIGHTING" criticized the business in January last he served the proprietor with a writ for libel. The action ran its usual course; but upon its being called on for hearing Dosteel failed to appear, and it was thereupon dismissed with costs. Counsel for the defendant, by leave of the Judge, was permitted to make a statement in order to prevent the public being further victimized; and, in doing so, he declared that he had evidence to prove that the business was a "gross and cruel swindle."

Curiously enough, very little notice appears to have been taken of the case by the Press, though the matter was one of very considerable interest to the public in general, and to newspapers in particular. From the public point of view, it surely should have been considered worthy of notice that a widely advertised home employment business was definitely stigmatized as a "gross and cruel swindle," and that the individual who was carrying on the swindle did not think it advisable to appear to rebut the aspersion. From the newspaper point of view, the case is still more interesting. Here we have a man swindling the public; and when in performance of its duty a newspaper warns the public against him, he promptly serves its proprietor with a writ, carries on the action to the very last moment—even until counsel are briefed—and then fails to put in an appearance on the day of the trial. The "JOURNAL," of course, gets a verdict with costs; but it is not likely that any costs will be recovered. Thus it is once more made clear that any rascal carrying on a dishonest business has it in his power to inflict, without any risk to himself, untold trouble and expense upon a journal which strives to do its duty to its readers. This has again and again been my experience in regard to libel actions; nor is it mine alone.

As regards Dosteel, the home employment trick which he practised, chiefly at the expense of persons with very limited incomes, is a very common one, and has been carried on from various parts of the country during the past five or six years. No doubt, Dosteel was wise in his generation in not allowing the evidence to go before a jury. But that evidence is in existence; and I have no doubt that it would be available for a prosecution if the police or the Treasury cared to avail themselves of it. Since Dosteel declined to face a Jury, it would be paying him back in his own coin if he were forced to do so. I commend this view of the case to Sir Charles Mathews.

In the course of the recent proceedings, attention was called to a paragraph in "Truth" for Aug. 17 last year (alluded to in the matter reproduced above), which had not been seen by the writer of the "JOURNAL" article that formed the basis of the libel action. It was as follows:—

The latest addition to the ranks of the home-employment harpies is a German who occupies a little office at 2, Gray's Inn Road, London, E.C., and calls himself the Incandescent Supply Syndicate. The circular which he sends to persons who reply to his advertisements states that he is prepared to teach free of cost the making of incandescent gas-mantles, a trade by which the employee, it is stated, can add from £1 to £3 a week to his income. The outfit required for the purpose costs, however, £2 os. 6d.; and when the mantles are delivered the "Syndicate" finds fault with them until the employee gets tired of sending more money for further supplies of materials. At least, that is the experience of one of the Syndicate's victims; for after the expenditure of £3, and a great deal of time and labour, he finds that he has only received 8s. for his work.

The "victim" here referred to was subpœnaed to appear in the "JOURNAL" action, and would have given evidence had the case proceeded in the usual way.

The following remarks on the case appeared in the "Ironmongers' Chronicle and the Hardwareman" last Wednesday:

Commercial, scientific, and technical journalists will feel a good deal of admiration for the stand taken by the "JOURNAL OF GAS LIGHTING" in connection with the action for libel reported on another page of this issue. The law of libel is such a rod in pickle, and the damages assessed by juries often so outrageous, that trade journalists usually choose language of studied moderation, even when conveying a warning of the utmost public interest. The "JOURNAL OF GAS LIGHTING" departed from the general rule in their references to a plan advertised by one Dosteel, by which anyone with forty shillings capital could set up in business as an incandescent mantle manufacturer. The aforesaid capital, however, had to be used in buying the necessary tools and materials from the advertiser; but once started it would be easy for anyone to make £3 a week. The "JOURNAL OF GAS LIGHTING" severely criticized the scheme; and Dosteel entered an action for libel against the proprietor, Mr. King. Prior to the hearing, it was intimated that the plaintiff would not appear; but in order to justify himself, Mr. King took the case into Court, and received a formal verdict, so that the statement of his Counsel might be given due publicity.

GAS COMPANY'S RIGHT TO LAY MAINS.

The case of *Schweder v. Worthing Gaslight and Coke Company*, which was reported in the last two issues of the "Journal" pp. 327 and 399, is one of considerable importance—both as to the legal points raised by it, and to its practical bearing on gas companies and their rights to lay mains. It may, therefore, be well to consider the case at a little further length, together with the judgment delivered by Mr. Justice Eve.

Most of the essential facts have already been given in the pages referred to. The legal questions raised are fortunately not confused by any issues of fact; the material facts of the case not being in dispute, and the constructional details of the work in question having being ascertained by an inspection of it by engineers representing both parties to the action. This common ground of fact may be shortly stated thus: The plaintiff is the owner and occupier of land on both sides of Goring Lane, running from Goring to Worthing. The defendants are a statutory gas company lighting the district of Worthing. They promoted a Bill in Parliament asking for power to acquire land in Goring for the building there of further gas-works to supply their district. The plaintiff and others unsuccessfully opposed the Bill; and by the Worthing Gas Act, 1907, the powers asked for by the defendants were granted. Thereupon, the plaintiff being desirous of thwarting the purposes of the defendants, caused to be made a passage or tunnel from one side of his land to the other. It consisted of brickwork and girders and concrete covering, and was completed in September, 1910. Early the following December, by working continuously from a Saturday to a Monday, the defendants laid the part of the gas-main complained of—it being a box-main laid on a thin piece of wood resting on a girder of the tunnel. To lay this main as it was laid, the defendants had to remove some of the concrete forming part of the tunnel. The plaintiff said that this was an unlawful interference with his property—in short was a trespass; but defendants said they were entitled to do what they had done by reason of the powers given to them by the Gas-Works Clauses Act, 1847, and the Worthing Gas Act, 1907.

Before considering the sections of the former Act which are material to this issue, it may be just as well to state what is really an elementary proposition of law. It is this: An act done that is lawful cannot be made unlawful by reason of any wrongful motive prompting the act. The law, generally speaking, does not concern itself with motives. "No use of property which would be legal if due to a proper motive can become illegal because it is prompted by a motive which is improper or even malicious" [*Bradford Corporation v. Pickles*, 1895, A.C. 587]. So that in the case we are considering the motives either of the plaintiff or the defendants are irrelevant and immaterial.

Now, section 6 of the Gas-Works Clauses Act, 1847, says: "The undertakers . . . may open and break up the soil and pavement of the several streets and bridges within the limits of the Special Act, and may open and break up any sewers, drains, or tunnels within or under such streets and bridges, and lay down and place within the same limits, pipes, conduits, service-pipes, and other works . . . and for the purposes aforesaid may remove and use all earth and materials in and under such streets and bridges. . . ." Then follows section 7, which adds: "Provided always, that nothing herein shall authorize or empower the undertakers to lay down or place any pipe or other works into, through, or against any building, or in any land not dedicated to public use, without the consent of the owners and occupiers thereof." Further, section 10 says: "When the undertakers open or break up the road or pavement of any street or bridge, or any sewer, drain, or tunnel, they shall with all convenient speed complete the work for which the same shall be broken up, and fill in the ground, and reinstate and make good the road or pavement or the sewer, drain, or tunnel so opened or broken up." Here we have the wording of the material sections, and can apply them to the case in question.

The contention of the plaintiff was that this tunnel was a building, and the main was laid against it, and therefore it is prohibited by section 7 of the Act. The defendants answer that the tunnel is not a building within section 7, but is a sewer, drain, or tunnel within section 6, and can therefore be broken up and interfered with.

Mr. Justice Eve arrived at the conclusion that the tunnel was a building; and that he was bound by authority so to find it—the authority being *Thompson v. Sunderland Gas Company* [1877, 2 Ex. D. 429]. In that case, certain old brick arches under a public road were used by the plaintiff, a shipowner, as store rooms. The gas company in laying their mains interfered with and damaged the top brickwork of the arches. A strong Court, consisting of Lord Cairns, L.C., Cockburn, C.J., and Bramwell, L.J., held that the arches were buildings within section 7, and that the gas company had no right to break into them.

Again, Mr. Justice Eve thought that the word "tunnel" in section 6 was used to describe something *ejusdem generis* with sewers or drains; and if so, it would not apply to a structure like the one in point. But even supposing it did apply, there was still section 10 to be considered, which imposed the obligation on the defendants of restoring and reinstating the tunnel so interfered with. "To reinstate and make good" does not mean chipping off parts of the roof of a tunnel; it means to restore it in the same state that it was before, and this had not been done.

In short, the defendants, so his Lordship held, had acted *ultra vires* in placing the main as and where they had done. They had committed a trespass, because there was no statutory authority protecting them. That was the principal question to be decided; the subsidiary one, as to whether or not the land involved was "dedicated to public use," it was not necessary to determine.

The decision in the case is obviously an important one for gas companies generally, though it is probably putting it too high to say, as Counsel for defendants did, that "if his learned friends were right, it would be impossible for any gas, water, or electric light company to lay mains in any district urban or rural" ["Journal," Nov. 7, p. 399.]. However this may be, the case forms another interesting authority to the many already existing on the interpretation to be put upon sections 6 and 7 of the Gas-Works Clauses Act, 1847. The mandatory injunction granted to the plaintiff was suspended for a month, in view of the possibility of the case being taken to a higher Court. We refrain for this reason for the time being from amplifying or further considering other aspects of this important and instructive case.

AMERICAN COMMERCIAL GAS ASSOCIATION.

[From a Correspondent.]

Your readers have already been told of the American Gas Institute meeting in St. Louis, from Oct. 18 to 20. On Oct. 21, a special train of ten sleeping, dining, and observation cars left St. Louis for Denver. It contained 125 persons who had attended the Institute meeting, and were now on their way to the convention of the National Commercial Gas Association, whose sessions were held from Oct. 24 to 26. A similar special from Chicago brought Eastern members who had not gone to the St. Louis meeting.

The Convention proceedings began on Monday night, Oct. 23, with an informal reception to the delegates, tendered by the Denver Gas and Electric Light Company, and held in their new office building. The illumination, both internal and external, of this modern ten-storey building is most striking. The building is beautifully outlined by the 200,000-candle power of the 13,000 lamps that stud its exterior. The interior appointments combine beauty with every contrivance for the rapid and economical performance of affairs.

The Convention met in the Auditorium, a building well adapted for the purpose, as, in addition to containing a large assembly hall, it affords ample space for the appliance exhibition, which is always a feature of these meetings. The first session was called to order by President Clare N. Stannard, on Tuesday morning, to listen to an address of welcome by Mayor Robert W. Speer. He congratulated the Association upon the great development of the gas industry, but warned it that each gas company must sooner or later share profits with the citizens from whom was derived the right to do business and use the streets. He bore testimony to the courteous service rendered by the Denver Company.

Then followed the Directors' report—a summary of the year's work as done by numerous Committees. Only a few important features may here be noted. A "Standard Handbook of Appliances" is now in use by some 60 manufacturers and 200 companies. As each new appliance is brought out, a loose leaf description of it is forwarded by the manufacturer to the gas company; and, being of standard size, it fits the handbook carried by the salesman. The convenience and economy of this method are obvious. The Association further plan to publish a handbook, classified and indexed, describing all the known industrial uses of gas.

A correspondence course in gas salesmanship has been inaugurated, with 725 members. It will continue for ten months; there being one lecture of ten questions issued monthly. Twenty company sections have been formed, and they report an increased interest taken by employees in their daily work. The Commercial Committee have sent out literature and instructions for pure-food shows, and gas-kitchen and general new business campaigns; and they now recommend an increased number of sub-committees, to specialize the work still further.

The membership has reached 2850, a gain of 1000 since December. In this connection, the Secretary recommended sending someone next year to visit those sections of the country not now well represented, to secure additional members. After reading the Directors' report, a halt was taken in the regular proceedings in order to elect to honorary membership Mr. Lucius S. Bigelow, the Association's founder. Then came the Treasurer's report, showing an excess of receipts over expenses of about $500, and a cash balance of $3121.

Mr. Philmer Eves, who, as a representative of the Gas Association, had recently read a paper on "Wasteful Ways of Using Gas in Hotels, Restaurants, and Clubs" before the International Stewards' Association, spoke of the benefits that would accrue from this opportunity of impressing upon stewards and *chefs* from all parts of the country the importance of economy and of co-operation with the local gas company.

Next Mr. J. M. Brock, the Chairman of the Advertising and Publicity Committee, presented their report. This was a recom-

mendation for a central advertising bureau, supervised by a Committee of the Association. The bureau would carry on a national campaign of advertising in trade papers. It would also furnish advertising matter to small companies for local use. It was estimated that a contribution from each gas company of one mill per 1000 cubic feet of sales would furnish the $250,000 which it is desired to spend this year on national advertising. It may interest those of your readers who are pleading the cause of the Publicity Committee of the Institution of Gas Engineers to be told that our syndicate companies here are in favour of the scheme outlined; and there seems good reason to believe it will be carried out.

The following office-bearers for the ensuing year were elected:

President.—Mr. C. L. Holman, St. Louis (Mo.).

Vice-Presidents.—Messrs. P. S. Young, Newark (N.J.). C. M. Cohn, Baltimore (Md.), and H. D. Schall, Detroit (Mich).

Treasurer.—Mr. W. H. Pettes, Newark (N.J.).

Directors (to serve two years).—Messrs. J. C. Rushin, Atlanta (Ga.), C. W. Wardell, Philadelphia (Pa.), F. M. Roberts, Fall River (Mass.), C. W. Hare, Philadelphia (Pa.), and George Williams, Montgomery (Ala.).

Our correspondent then refers to the Presidential Address and to the papers read. Some of these are abstracted in this issue (pp. 465-68); and the remaining ones will be similarly dealt with next week, when the second portion of our correspondent's report will also appear.

WATER LEGISLATION FOR 1911.

[Second Article.]

In the last number of the "Journal," the Acts obtained by Water Companies in the present session were noticed. To-day we deal with some of the measures of Local Authorities containing proposals in reference to water supply.

The Blackburn Corporation Water Act sanctions and confirms the construction of certain works, authorizes others, confers further powers with respect to the supply of water, and enables the Corporation to raise more money. The works for which sanction is obtained consist of a reservoir already commenced, in the county borough of Blackburn; and those proposed to be constructed comprise a reservoir partly in Rishton and partly in Wilpshire, in the rural district of Blackburn, four conduits or pipe-lines, a culvert, and some alterations of a road and footpaths. Ten years are allowed for the completion of these works, and the Corporation are granted an extension to twenty years from the passing of the Act of the time limited by their Act of 1898 for the construction of the Brennand and Whitendale reservoirs and other works authorized by the Act of 1877. Borrowing powers to the extent of £75,500 are conferred for the purchase of lands and the carrying out of the works authorized by the present Act—to be repaid within fifty years from the date or dates of borrowing. [*Parliamentary Agents: Messrs. Tahourdin and Birds.*]

The City of London (Various Powers) Act confers upon the Corporation further powers with respect to the control and repair of streets. Section 31 provides that in the event of any street or pavement being sunk, broken, or damaged by the breaking or defective condition of any water mains or pipes laid beneath the surface, or in the event of such street or pavement being opened for the purpose of repairing such mains or pipes, the Corporation or their engineer may cause notice to be given to the owners forthwith to make good the ground to the reasonable satisfaction of the Corporation or their engineer; and if the repairs are not carried out within 24 hours after the service of the notice, the Corporation may execute the work and recover the cost from the parties concerned. Any dispute arising in connection with this matter is to be settled by an engineer to be appointed by agreement, or, in default, by the President of the Institution of Civil Engineers. Section 37 gives protection to the Metropolitan Water Board and the London Hydraulic Power Company. It is provided that, notwithstanding anything contained in section 31, it shall not be lawful for the Corporation, without the consent in writing of the Board or the Company, to repair any main or pipe belonging to them. In any case in which the Corporation exercise the powers of section 31, as varied by section 37, with respect to any street or pavement which has been damaged and is under repair by the Board or the Company, these bodies are not to be liable for any penalty under section 139 of the City of London Sewers Act, 1848, or otherwise, in respect of the failure to cause the ground to be filled in and rammed down, and the pavement to be relaid and repaired. [*Parliamentary Agents: Messrs. Rees and Freres.*]

In a General Powers Act obtained by the Gloucestershire Corporation, authority is given for the construction of additional water-works, consisting of a well and pumping-station in the parish of Pauntley, an aqueduct or pipe-line from it to a junction with the outlet-pipe from the more northerly of the two reservoirs of the Corporation at Madams Wood, and an approach road. Five years are allowed for the completion of these works. The Act contains a long section protecting the Newent District Council and owners and occupiers in the Ketford areas. It is provided (*inter alia*) that if it shall be proved that the pumping by the Corporation at the well at the Pauntley pumping-station has caused any diminution of the supply of water in any private well or watering-place for animals supplied from a spring or streamlet, and existing as an effective source of supply at the time of the passing of the Act, such well or watering-place being situate within the Ketford protected area, the Corporation are to make up the deficiency, on being requested in writing to do so. And if it shall be proved that any private well or watering-place has afforded an effective source of water supply in dry as well as in normal seasons since 1895 or for a reasonable number of years, not exceeding eighteen, prior to pumping at the above-mentioned well, and that the supply was only diminished after the date when such pumping commenced, the Corporation are to accept this as *primâ facie* and sufficient evidence of the supply having been diminished by pumping at the well, unless the Corporation prove otherwise. If they do not therefore afford a supply of water equal to the diminution, they are to make compensation in money. Further, if the pumping at the new station causes any material diminution in the flow of the River Leadon, they are to compensate parties interested in the river, including those having mills or fishing rights. Authority is given to borrow £27,000 for the works specified, to be repaid within forty-five years. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Another General Powers Act is that obtained by the Halifax Corporation; and by it they have authority (*inter alia*) to construct works and make better provision with regard to their water undertaking. They are empowered to construct a line or lines of pipes in the parish of Wadsworth, in the West Riding of York, and a wall in extension of the existing centre wall of the dam of the Walshaw Dean Lower Reservoir. The Corporation are authorized to alter the date for the payment of water-rates; but no person is to be compelled to pay them for any longer period in advance than three calendar months. They may also compound rates with owners, and allow them a deduction to the extent of one eighth. The Corporation are granted large new borrowing powers in connection with their water undertaking—the principal amounts being £53,516 for repayment of the sum expended upon the construction of the Walshaw Dean reservoirs, £23,000 for their completion, and £30,000 for the purchase of lands and the construction of the works authorized by the present Act. They are allowed forty-five years for the repayment of the first-named amount, and fifty years for the two others. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

The Harrogate Corporation Act extends by three years from Aug. 9, 1911, the time specified in their Act of 1901 for the completion of the reservoir thereby authorized. The rates for the supply of water are altered as follows: Where the rateable value of the premises supplied does not exceed £5, the charge is to be 8s. 8d.; where it is more than £5, the rate is not to exceed 10 per cent. of the rateable value. The Act contains a section protecting the Wetherby District Water Company in case the Corporation undertake any works within the Company's area. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Hastings Corporation have obtained an Act giving them further power with respect to the water supply of the borough, and also authority for the construction of additional works and the purchase of the lands on which the existing works have been built. The lands are all situated in the parishes of Catsfield, Crowhurst, Bexhill, and Hastings; and the proposed works comprise three pumping-stations, a service reservoir, and six conduits or pipe-lines. The Corporation are granted a period of ten years within which to complete these works, and are authorized to raise £27,995 for the purchase of the lands upon which the existing pumping-stations stand, £27,948 for the engine-houses, &c., at the Forewood, Crowhurst, and Pebsham pumping-stations, £12,364 for the laying of water-mains, and £9522 for engines and pumping plant, fencing road, &c.—to be paid within sixty, fifty, forty, and thirty years respectively from the dates of borrowing. The Act contains a number of provisions protecting sources of supply, the Bexhill Water and Gas Company, and other companies and local bodies. [*Parliamentary Agents: W. & W. M. Bell.*]

In a General Powers Act obtained by the Hornsea Urban District Council, authority is given to make better provision in regard to the supply of water. Where water supplied for domestic purposes is used for washing horses, carriages, or motor-cars, or for other purposes in stables or premises where these are kept, the Council may, if a hose pipe or other similar appliance is used, charge such additional sum, not exceeding 20s. per annum, as they may prescribe. They may make bye-laws for preventing waste of water; and if these are not observed they may, after due notice, repair the defective fittings causing the waste, and recover the cost. The provisions of the Act are to apply to the existing water undertaking, which the Council are to continue to carry on under the powers of the Public Health Acts relating to water supply. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Ipswich Corporation Act gives authority to the Corporation to construct a pumping-station in the parish of Whitton, in the rural district of Bosmere and Claydon, and a conduit or pipe-line connecting it with the existing reservoir of the Corporation in the borough of Ipswich. Five years are allowed for the completion of the works. The Corporation may purchase and hold lands and exercise powers for the protection of their water and water-works, and make bye-laws for the prevention of pollution. The Act contains provisions for the protection of the Corporation and the Felixstowe and Walton Water Company, the Ipswich Gas Company, and certain wells, and also for the supply of water in bulk to the Bosmere and Claydon Rural District Council. The price to be charged for water supplied by measure is not to exceed

1s. 6d. per 1000 gallons; and for a supply by hose-pipe to stables, &c., a sum not exceeding 20s. per annum may be imposed. Power is given to borrow £21,000 for the purchase of land in connection with the construction of the works specified, and £5000 for new mains, extensions, and other purposes, for repayment of which sums periods of forty and fifty years respectively are granted. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

By the Kingston-upon-Hull Act, authority is given to the Corporation (*inter alia*) to construct water-works and extend their limits of supply. The works comprise a pumping-station at Dunswell, in the urban district of Cottingham; a water-tower in the parish of Marton, in the rural district of Skirlaugh; another in the parish of Rimswell, in the rural district of Patrington; and seven conduits or pipe-lines. Seven years are allowed for the completion of these works. The limits of supply, as extended by the Act, include the rural districts of Patrington and Skirlaugh; and the rates chargeable in the new limits, for water used for domestic purposes, range from 8s. 8d. per annum where the gross estimated rental of the premises supplied does not exceed £5, up to 8 per cent. per annum where it is above £100. The charge for water supplied by measure is not to exceed 2s. per 1000 gallons. Provision is made for the supply of water in bulk to the Corporation of Hedon and the Urban District Councils of Hornsea and Withernsea. The Corporation are authorized to borrow £30,500 for the purchase of lands and the making of the well and boreholes, &c., £25,000 for the provision of machinery, £17,500 for the erection of the pumping-station and the water-towers, and £47,000 for new mains, extensions, and other purposes. Various periods are specified for the repayment of these amounts. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Corporation of Merthyr Tydfil have obtained authority to construct an impounding reservoir in the parishes of Llanfigan, Llanddetty, and Vaynor, in the county of Brecknock. It will be formed by means of a dam across the River Taf Fechan; and in connection with it there will be four pipe-lines and three road diversions. Ten years are allowed for the completion of these works. After the reservoir is finished the Corporation are to send into the river, at a point not more than 300 yards below the foot of the dam, not less than 6,835,000 gallons of water in a continuous flow every 24 hours. The Corporation may sell water by measure, at a price not exceeding 1s. 6d. per 1000 gallons; and also supply fittings. Authority is given to borrow £399,972 for the purchase of land for, and the construction of, the water-works and road diversions specified—to be repaid in sixty years. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Presentations to Mr. Frost, of Norwich.

On Monday evening of last week, the Norwich staff of the British Gaslight Company assembled at the Maid's Head Hotel, on the invitation of the Chairman and Board of Directors, for a dinner given in honour of Mr. C. G. Frost, the Chief Clerk of the Norwich Station, who has just completed fifty years' unbroken service with the Company. The chair was occupied by Mr. J. Horsley Palmer, the Chairman of the Board, who was supported by Mr. A. W. Brookes, the Secretary at the London Office, and Mr. Thomas Glover, the Engineer and Manager of the Norwich Station. Previous to the commencement of the evening's proceedings, Mr. Frost was the recipient of numerous congratulatory letters and telegrams from other stations of the Company, and friends. After dinner, the Chairman proposed the toast of the evening, "Mr. C. G. Frost," and, in well-chosen words spoke in terms of highest commendation of his long and efficient service. He asked Mr. Frost to accept, in token of the appreciation of the Board, a gold English lever watch (suitably inscribed) and chain. On behalf of the Manager and local staff, Mr. Glover then presented Mr. Frost with a massive silver salver, engraved with words fitting to the occasion. Mr. Frost, in reply, expressed his heartfelt thanks to the Chairman and Directors and the staff for the gifts, which he said would always be regarded as heirlooms. The toast, "Success to Gas," proposed by the Chairman, was responded to by Mr. Glover, who, in the course of his remarks, enlarged on the remarkable progress and the successful business enterprise of the British Gas Company in Norwich and elsewhere. The musical programme was contributed to by the Apollo Quartette Party and by several members of the staff, while the accompaniments were ably rendered by Mr. Brookes. The previous Saturday, Mr. Frost was the recipient of a handsome silver-mounted walking stick from the officers of the prepayment meter department at the City Office.

The German Association of Gas and Water Engineers will hold their meeting next year at Munich on June 24-27; the 25th, 26th, and 27th being reserved for the technical proceedings.

Machinery for testing road surfaces and road-making materials is to be installed in the new laboratory of the Road Board, the preparation and building of which has now commenced in connection with the National Physical Laboratory at Teddington. When complete and fully equipped, the new laboratory will have cost £1850; and the annual expenses, it is estimated, will amount to £1800. Tests are to be carried out not only for the Board but also for local authorities, quarry owners, and road contractors, who will be able to submit their materials for tests of strength, endurance, and general suitability for road-making.

INSTITUTION OF CIVIL ENGINEERS.

Dr. W. C. Unwin's Presidential Address.

THE theatre of the Institution of Civil Engineers was crowded last Tuesday evening to hear the new President at the opening of another session.

Dr. W. C. Unwin, after taking the presidential chair vacated by Mr. Alexander Siemens, began his address by remarking that the choice of President this year had fallen on one who was not of that usual class of engineers from whom previous Presidents had been selected—that is from engineers renowned for the magnitude of the works executed by them—but on one who belonged more to the academic or professorial side of engineering. It must at once be added, however, that (as is well known) the new President is by no means unknown for his achievements on the constructional side; and, as he himself observed later on in his address, most engineering professors were themselves engineers of considerable practical experience. It was also most happily phrased by Sir Alexander Kennedy, in proposing a vote of thanks to the President for his address, that Dr. Unwin was the only one of some four other former professorial Presidents who had kept to his own business.

Dr. Unwin's address may be concisely described as dealing with the training of men and the straining of material—though the latter topic was considered first. We need not here follow it in detail. Suffice it to say that the work of early investigators into the problems of ascertaining and testing the strength of materials was rapidly reviewed—starting with Galileo [1564 to 1642], mentioning Robert Hooke [1660], who discovered that stress was proportional to strain, Muschenbroek [1729], who first published precise results of tests, Perronet [1758], who built the first large testing machine, followed by Rondelet [1787], Labardie, Girard, Brunton and Co. [1813], and Captain Sam Brown [1817], the two last-named having constructed cable-testing machines, used by Telford, assisted by Peter Barlow, Professor of Mathematics at Woolwich Academy, in the Menai suspension bridge. It is noteworthy that down to the early part of last century, most of the knowledge relating to the strength of materials came from Continental engineers and experimenters. Then in England came Thomas Tredgold [1820], and later Eaton Hodgkinson [1860].

Dr. Unwin next proceeded to consider various working stresses and formulæ with regard to them. He seemed to sound a note of warning; for he said that however valuable data of breaking strength and elasticity might be in guiding the engineer, they could not take the place of actual experience—a caution which brought across one's mind the catastrophe of the Hamburg gasholder.

Turning to the more general subject of the training of men, or engineering education, the professorial President gave utterance to some very sound and progressive views, casting a comparative survey over the Continental and British methods of educating engineers. One realized the present position of England in the matter, when one remembered that what we should now call technical schools, or the first engineering schools were established on the Continent in the latter part of the eighteenth century, or nearly a hundred years before anything similar was attempted in this country. The "Ecole des Ponts et Chaussées" in France, for example, had thus all this start of us, in addition to other *écoles* there and in Germany. For years and years after these countries had organized their secondary and technical education, England was blindly trudging on with its practical training and its rules of thumb. The engineer of to-day had to be a very different man from that of an earlier period. As Dr. Unwin put it, he had not now solely to be concerned with engineering problems; he had to be familiar and able to cope with economic, legal, and commercial matters. While listening to such observations from an acknowledged expert, we were reminded of the great applicability of such truths to some present phases of gas engineers and engineering. The day of the untutored, narrow, specialized gas engineer, who has learnt his few empirical rules of practice in his own retort-house and works, has gone—and gone for good. Not that practical training is for a moment to be undervalued; for, as the President said, what was doubted by engineering professors was only the value of the old apprenticeship system, unknown in any other country, which they considered uneconomical, wasteful, and unfair. Practical engineers, he thought, had a tendency to suspect those who were interested in technical instruction of being indifferent to the value of practical experience; but that was quite a mistake. What professors did question was the value of the experience gained by an ordinary apprentice going into works straight from school, and having to pick up what he could as he went along. A sound, scientific knowledge should first of all be obtained before entering upon any practical pupilage.

These are the views, it may be remembered, that were urged in the "JOURNAL" at the time of the recent engineering conference on training, and also on the publication of the report of the special commission on technical instruction of the Société Technique du Gaz. The members of the commission will feel gratified that the system of French training and education is supported and eulogized in such an important address as that of the President of the Institution of Civil Engineers.

Dr. Unwin's address was listened to with close attention, and the applause at its conclusion was unusually hearty and prolonged, and showed emphatically how much it had been appreciated.

SOUTHERN DISTRICT GAS ASSOCIATION.

Autumn Meeting.

The Autumn Meeting of the Association was held at the Hotel Cecil, Strand, W.C., last Thursday—the PRESIDENT (Mr. H. C. Head, of Winchester) in the chair. There was an excellent attendance of members.

The minutes having been taken as read, a letter of regret at inability to attend the meeting was read from the President of the Institution of Gas Engineers (Mr. R. G. Shadbolt).

ELECTION OF OFFICE-BEARERS.

The PRESIDENT said the next business was the election of officers for the ensuing year. He had great pleasure in proposing that Mr. B. R. Green, of Mitcham, should be the next President. Mr. Green was well known to all the members; and he was sure it required no words from him (the President) to commend him to the members. The more they knew of him, the more they liked him.

Mr. T. MAY (Richmond) seconded the motion. He observed that Mr. Green's name had been known in the Association, father and son, for a great many years. It was an old gas family whom they all deeply respected. He knew, from what Mr. Green had done at Mitcham, that they would find him a very able President for the Association.

The motion was cordially adopted.

Mr. GREEN thanked the members very much for the honour conferred upon him in electing him to be President of the Association in the coming year. He realized fully the responsibilities attaching to the office; and he should do his best to carry them out in the manner the members would wish. He felt a certain encouragement in taking up the duties because his recent experience as Vice-President had shown him the help the President received at the hands of the members. He felt confident the members would extend like assistance to him during his year of office.

Mr. A. E. BROADBERRY (Tottenham) said he had much pleasure in proposing that Mr. H. O. Carr, of Wandsworth, be their Vice-President for 1912. Many of them in the Association knew well Mr. Carr's brilliant career; and he certainly had done very much for the benefit of the gas industry. In London, he had set some of them a very hard task in regard to the price of gas; but they were doing the best they could to follow him. They all looked forward to him taking a more prominent place in the Association, so that they might benefit by his advice as well as example.

Mr. FRANK LIVESEY (Maidstone) seconded the motion; and it was unanimously carried.

Mr. CARR, in acknowledging his election, said he was much indebted for the honour the members had done him. He must say that this came rather as a surprise to him; and perhaps it was the more acceptable on that account. He should do all he could to uphold the President during the year, as well as the traditions of the Association.

The PRESIDENT said the next resolution referred to the Hon. Secretary and Treasurer; and they all knew perfectly well that he was going to propose the re-election of Mr. W. E. Price. He wanted to propose this, because until one had been President, one really did not know the value of their Hon. Secretary. He was the permanent official, and for the success of the Association he was practically responsible.

Mr. F. C. TAYLOR (Shanklin) seconded the motion; and it was very heartily carried.

Mr. PRICE, in thanking the members, said that, so long as they had pleasure in re-electing him in the way they had done on this occasion, he should have pleasure in serving the Association.

Mr. J. T. JOLLIFFE (Ipswich) proposed that Mr. Thomas Glover and Mr. J. W. Auchterlonie be members of the Committee.

Mr. W. B. RANDALL (Waltham Cross) seconded the motion; and it was heartily agreed to.

Mr. T. GLOVER (Norwich) having acknowledged the honour conferred upon him and his absent friend Mr. Auchterlonie,

Mr. A. F. BROWNE (London) proposed the re-appointment of Mr. J. L. Chapman and Mr. A. Dougall as Auditors.

Mr. W. G. HEAD (London) seconded the motion, which was unanimously carried.

NEW MEMBER.

The name of Mr. A. E. Saville, of Farnham, was added to the roll of membership.

BRITISH COMMERCIAL GAS ASSOCIATION.

The PRESIDENT desired to make a statement with reference to the British Commercial Gas Association. There was one matter which particularly affected the Association as such; and there were two or three other points to which he should like to allude in a general manner. First of all, he took it that every member had received a letter dated Nov. 3 from the President of the Institution of Gas Engineers. Should there be a member who had not had a letter, he hoped the fact would be made known, so that he might have one. There were really three letters sent out—one addressed to full supporters of the Commercial Association, the second addressed to partial subscribers, and the third to non-subscribers. The letter addressed to non-supporters gave a clear and concise description of the objects of the Commercial Association, and any undertaking that was not a subscriber should have this letter, so that it could be brought before the Board or Committee, and their support be obtained. He believed it was absolutely common knowledge, but he should like to mention it again, that support to the extent of £10,600 per annum had already been promised. This sum was exclusive of the subscription of the Society of British Gas Industries, who had already expressed themselves, through their Chairman, as being heartily in accord with what had been done, but there had not yet been a general meeting, so the Society had not thus far been able to promise any definite subscription. If he might speak of a matter of interest for a moment, this Commercial Gas Association was of particular concern to the Southern District Association, because the whole matter originated from their Commercial Section. The Southern District Commercial Section only started in 1908; and from the section there had already been developed this large representative Association, with a very large income, which he hoped would do much for the benefit of the gas industry as a whole. The question of the election of members of the Committee of the Association was one to which he had to particularly draw attention. So as to prevent one area being unduly represented, the kingdom had been divided into districts; and the subscribers who nominated members would elect representatives from their own particular area. They would have practically no voice in the election of members of Committee from the other areas. The division of the country was into the following areas: Eastern District, Ireland, Manchester District, Midland District, Northern District, Scotland, Southern District, South-Western District, and Wales. The districts particularly interesting to the Association were the Southern and the South-Western. The boundary of the South-Western district would be from the south-east corner of Monmouthshire cutting down to the Solent. This would form the eastern boundary, and, of course, the coast-line would form the remainder. Then came the Southern district, with the Midland boundary on the north, and the south-west boundary on the west; and from the Midland district south-east corner to the Thames at Canvey Point would be the east boundary, the coast-line would be the southern boundary, and that would include the Isle of Wight. The Midland boundary forming the north of the Southern district would be from the south-east point of Monmouthshire through Buckingham to a point south-west of Bedford. In the Southern district there was a total sum of £4988 promised; and the members to be elected for the Committee were in the ratio of one to every £500 subscribed, so the southern district would be entitled to nine members. Incidentally, he (the President) might say there was a grand opportunity for someone to subscribe another £12; and then ten members could be nominated for the subscription of £5000. They would be able to nominate ten members who would be sent up to the Association; and from the ten five would actually be elected members of the Committee. The whole of the work of organizing the preliminary elections or nominations would be in the hands of the Southern District Association. This was why it was particularly mentioned on this occasion. He would, in conclusion, read a few words used by the President of the Institution at the general meeting, on Oct. 12, at which the Commercial Association was started. He said: "May I ask those Presidents and Secretaries of the Associations who are here present to look round and see in what respect they can facilitate the formation of a Committee." In pursuance of this request, the subject was now brought forward. In addition to assisting in the formation of a Committee, they could, he (the President) hoped, assist very largely in the development of the Association as a whole. In the Southern district, there were about 125 undertakings represented by members of the Association that could become members of the new Commercial Association, and only 56 up to the present had agreed to become subscribers. A further 29 undertakings who were not represented in the Southern District Association, but who were in the southern and south-western areas, had also subscribed.

The HON. SECRETARY (Mr. W. E. Price, of Hampton Wick) remarked that the Commercial Gas Association had asked the Secretaries of the District Associations to act as intermediaries in the matter of elections. This being the case, in a very short time, when he had received the names of the members of the undertakings who had agreed to subscribe, it would be his duty to call a meeting of the undertakings for the consideration of nominations for the Committee. This would have to be done very soon now, so that those who had subscribed would shortly be hearing from him. He took it the meeting would be held in London as being a good centre.

EDUCATION OF GAS-FITTERS.

The PRESIDENT said the subject of the education of gas-fitters was brought forward by the Manchester District Association; and the other District Associations were asked to send a representative to the conferences on the question. Mr. James Paterson was selected by the Committee to represent the Association. He

would ask him to make an announcement as to what had transpired.

Mr. JAMES PATERSON (Cheltenham) said he regarded this as a really important matter. The President had mentioned that the question had been under consideration. There had been several meetings during the past few months—at Leeds, at Manchester, and one in Glasgow at the time of the Institution meeting—for the consideration of a scheme for the education of gas-fitters. The final stage was reached a few weeks ago at Manchester, when a meeting of delegates was held. A scheme was drafted, and was accepted after considerable debate; and the Chairman of the conference (Mr. Robert Watson, of Doncaster) asked each delegate to bring the scheme before his Association for acceptance. The scheme had been approved by the Committee of their own Association that day; and in order that the matter might be put in proper order, the President had asked him to read the scheme to the members, so that they might know what could be done. They asked for formal approval of the action of the Committee. The scheme was as follows:

Scheme for Education and Certification of Gas-Fitters.

(1) The Committee recommend it is advisable that classes in gas-fitting and the use of gas appliances should be formed in connection with all technical schools; and where technical schools are not available, that a limited number of small towns should be grouped together and classes promoted at a fixed centre (on a gas-works if no other place is available).

(2) That a syllabus be adopted, to be taken concurrently with a course of practical gas-fitting (comprising pipe-jointing in lead and compo, iron barrel work, brass work, attending to incandescent burners, stoves, &c.) to be conducted by a practical gas-fitter.

(3) Gas-fitters to be required to attend regularly courses on gas and the use of gas appliances to the satisfaction of the instructors, who will certify to that effect.

(4) Full certificates to be issued by the authority of the Local Committee to working gas-fitters over the age of 21 years, on certification of attendance from the instructors, and proof of due completion of their apprenticeship.

(5) The City and Guilds of London Institute to be asked to include the subject in their syllabus as a supplementary course for gas-fitters.

(6) The whole course to be under the superintendence of a Local Committee, who would recommend the instructors. The Local Committee shall comprise representatives of gas undertakings and trade associations (if any) within the same areas.

(7) The question of raising ths necessary funds for carrying on the work to be left to the Local Committee in each district.

(8) The scheme having been reconsidered by this Committee after the discussions at Doncaster and Glasgow, shall be submitted to a full meeting of representatives of the District Gas Associations and Trade Associations, after which it will be referred to the Institution of Gas Engineers before the various authorities are approached.

The scheme was approved.

PAPERS READ.

There were two papers before the meeting. The first was by Mr. JAMES PATERSON, on "The Coal-Liming Process at Cheltenham;" and the second, by Mr. C. P. CLEASBY, on "New Carbonizing Plant at Guildford." The text of both papers is given elsewhere, together with full reports of the discussions.

At the close of the debates,

Mr. JAMES W. HELPS (Croydon) proposed, and Mr. W. B. FARQUHAR (Ilford) seconded, a very hearty vote of thanks to the authors of the papers.

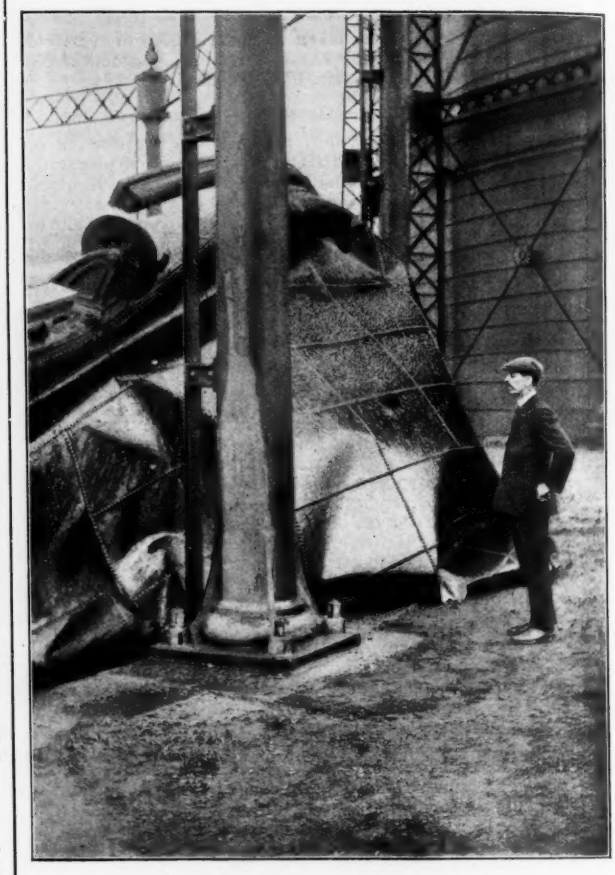
Cordial concurrence in the resolution concluded the proceedings.

Professor Lewes's Lectures on Coal Carbonization.

It was mentioned in the last number of the "JOURNAL" that Professor Vivian B. Lewes, F.I.C., F.C.S., will deliver a course of four Cantor Lectures at the Royal Society of Arts on Monday evenings, commencing on the 27th inst. We have now received a syllabus of the lectures. In the first, Professor Lewes will discourse on the composition of coal, and deal with existing theories on the subject, the chemistry of coal formation, the classification of coals, and the effect of their composition on the products of decomposition by heat; concluding with some remarks on coking and non-coking coals. The second lecture will be devoted to a review of the methods employed in the destructive distillation of coal. Professor Lewes will explain the changes which have taken place during the past century in the form and setting of gas-retorts direct attention to the progress made in the last ten years and the present position of the gas industry, and also of the coke industry, in view of the gradual development of the modern products-recovery plant, and direct attention to the influence of the retort or oven on carbonization. In the third lecture, the thermal conditions existing during the carbonization of coal will be considered, including the heat value of the reactions taking place in a retort, the losses of heat in a setting, the transmission of heat through the retort and the charge, the relative value of small and full charges, and the influences which lead to improvement in the products from full charges, and chamber and vertical retorts. The concluding lecture (on Dec. 18) will be specially interesting, as Professor Lewes will consider the possible improvements in carbonization. The salient features of this lecture will be the rivalry existing between fully charged retorts, vertical retorts, recovery ovens, and chamber carbonization, the intermittent as compared with continuous vertical retorts, ideals of carbonization, and the ends to be kept in view in devising new processes.

A WRECKED HOLDER AT LANCASTER.

THE heavy gale at the end of the week before last was responsible for damage at more than one gas-works. As an instance may be cited Lancaster, where there was wrecked the holder shown in the accompanying photograph, forwarded by Mr. Charles Armitage, the Engineer and Manager of the works.



The Lancaster Holder after the Accident.

The holder, which was erected in 1864, is a single-lift one, 100 feet diameter, and 20 feet deep. Many years ago, in the time of the Gas Company, a cast-iron weight of about 10 tons was fixed all round the holder, immediately over the top curb, to give an increase of pressure; and this, together with the heavy crown trussing employed, made the top particularly heavy. The severe gale on the Sunday caused the holder (which was nearly full at the time) to rock, and to break a cast-iron carriage on the opposite side to the wind. Other carriages soon followed, which gave more freedom to the holder, with the result that it became a total wreck. One side landed at the bottom of the tank, and the other (to windward) on the coping of the tank. It is pointed out that had the weight been fixed to the bottom of the holder, the accident in all probability would not have occurred. Beyond the wrecking of the holder, no further damage was done to the works; and it is gratifying to learn that no one was injured.

Scottish Junior Gas Association—Western District.—Members of the Association are to pay a visit, next Saturday afternoon, to the Barrowfield Iron-Works, Glasgow.

Unveiling of the Livesey Statue.—The Rt. Hon. Earl Grey, G.C.M.G., has consented to unveil the memorial statue of the late Sir George Livesey erected at the Old Kent Road works of the South Metropolitan Gas Company. The ceremony will take place on Friday, Dec. 8.

Constituents of Coal.—In a recent number of the "Comptes Rendus," an account was given of investigations on this subject by MM. Aimé Pictet and Louis Ramseyer. The authors employed two methods to obtain definite compounds from coal—firstly, extraction with organic solvents; and, secondly, distillation under diminished pressure at as low a temperature as possible. They thus isolated a hexahydride of fluorene. At a higher temperature it loses hydrogen and yields fluorene. This transformation is one source of the formation of the aromatic hydrocarbons of tar, as well as of the hydrogen of coal gas. In noticing this matter, the "Chemical News" says the authors' experiments confirm to a certain extent Donath's hypothesis, that coal is a mixture of originally liquid compounds which have gradually become solid owing to polymerization.

THE LIMING OF COAL IN GAS MANUFACTURE.

By James Paterson, of Cheltenham.

[A Paper read before the Southern District Association of Gas Engineers and Managers on Thursday, Nov. 9.]

It would be an advantage in the treatment of the subject of this paper to trace briefly, in chronological order, the various attempts which have been made during the last century to bring about the successful carbonization of coal when mixed with lime. For my information, I am indebted to the invaluable files of the "Journal of Gas Lighting."

Early History of Coal-Liming.

The liming of coal is no new thing. The conception of it, at any rate, is over one hundred years old; for in June, 1806, a chemist named Heard patented a process for stratifying lime with coal, in order to reduce the sulphur in the resultant gas.

In February, 1809, the celebrated Winsor patented the liming of coal; but he found that when the lime was thrown over, and mixed with, the coal, the coke was "affected more or less." Accordingly, he suggested in his patent that the slaked lime should be thrown at the bottom of the oven or stove, and "sprinkled over with a little water, the steam of which will rise through the coal, and impregnate itself with the smoke, to purify it the better from the disagreeable odour."

Another patent was obtained by one Uriah Haddock, in May, 1819, for mixing lime with coal.

Coal-liming had a long rest after this, so far at least as the Patent Office is concerned, until June 2, 1882, on which date Mr. W. J. Cooper's famous patent was granted for "Improvements in the distillation of coal, in and for the manufacture and production of coal gas, consisting in the admixture and use of lime." Cooper claimed the following advantages: Increased production of ammonia, increased illuminating power, diminution of impurities in the crude gas, and improvement of the resultant coke for certain purposes.

The basis on which Cooper advocated the adoption of his process was the increased yield of ammonia, in the early stages of its history at any rate. But his later pleas for adoption seem to have resolved into claims for extraordinary purity of the gas, and consequent long duration of the working periods of oxide purifiers—a condition of working which appears to have been due to nothing more or less than an application of what we now know as revivification *in situ* by means of air.

By Cooper's process, 2½ per cent. of lime—that is 56 lbs. of lime to one ton of coal—was first damped with its own weight of water, and then sprinkled over the heaps of coal lying on the retort-house floor in front of the bench. Cooper states that he found on a 50-ton test that he obtained a 35 per cent. increase of ammonia, and on a later test of the same quantity of coal, a 100 per cent. increase. Mr. J. A. Wanklyn pointed out at the time that it was reasonable to suppose that the carbonization of coal with lime was likely to produce a ready evolution of ammonia, in larger quantity than when coal alone was placed in the retort.

In a paper read by Mr. Cooper before the North of England Association in May, 1883, he stated that the coke produced burnt more brightly than ordinary coke, and that thousands of tons had been sold without any complaint as to quality. A further claim (as to which not much subsequent notice seems to have been taken) was that the adoption of the process prevented the stoppage of ascension pipes. A test at the Vauxhall works was in progress, where 3000 tons of coal per week were subjected to liming; and it was found the sulphur compounds were reduced by one-half, and the sulphuretted hydrogen by one-third.

At the meeting in 1883 of the Gas Institute, the President (Mr. R. O. Paterson), in his address, said that in laboratory experiments he found 20 per cent. increase of ammonia, 13 per cent. increase of tar, but no alteration of illuminating power. The coke was found to be deteriorated, and to be useless for domestic fires, owing to the presence of nodules of lime scattered through the coke. The yield of gas was found to be unchanged, from which the President inferred that the temperature of distillation had not varied in making his comparative tests.

From this time onwards, for the next few years, greatly varying and hopelessly discordant results seem to have been obtained by various gas engineers throughout the country. The late Mr. Wanklyn was a persistent and enthusiastic exponent of the process; and in various addresses given before scientific and technical societies, he repeatedly dwelt upon the advantages of Cooper's process, though there appears to be a dearth of authentic figures from the few gas-works which had made a continuous application of the new method of carbonizing.

In one of his lectures before the Society of Chemical Industry, in London, Wanklyn admits that the coke contains more ash, and as the ash was more fusible, when coke was used for furnace work somewhat more attention was necessary to clinkering. This explanation appears to have been called for by the almost universal complaint that the process entailed serious destruction of the furnace ironwork and furnace linings. It may be mentioned here that some engineers complained of the excessive dust in the retort-house—one engineer stating that his stokers looked like millers.

A paper by Mr. T. Duxbury, of Darwen, in March, 1886, before the Manchester District Institution of Gas Engineers gave a careful summary of the advantages and disadvantages of the process, derived from his own experience. He arrived at the result that the net loss sustained by the adoption of Cooper's invention amounted to 3·08d. per ton of coal carbonized.

The process is stated to have been worked continuously at Tunbridge Wells for a period exceeding four years. But with the death of Mr. R. P. Spice (another strong advocate of Cooper's process), in May, 1889, further reference in the technical records ceases, and apart from probable tentative but unpublished efforts at resuscitation by undaunted engineers, coal-liming appears to have been left severely alone until the year 1910.

Revival at Cheltenham.

The Cheltenham Gaslight and Coke Company obtained the repeal of the sulphur clauses in their Act of 1906; and although release from restriction dated from July of that year, it was only gradually that the use of oxide for purification was introduced, and the use of lime abandoned. In April, 1907, oxide began to be used alone; and the immediate and natural effect was an increase of sulphur compounds. The town gas undoubtedly betrayed the presence of sulphur dioxide on its combustion, and it was found desirable to revert to the partial use of lime purification—thus bringing back the old trouble of difficulty of disposal of the spent material.

In the hope of solving the difficulty by means other than lime purifiers, a hopper was constructed—closed at the bottom by a roller and flexible shoot—which was placed over the teeth of the coal breaker, and filled with ground lime. The continuous rotation of the roller, by gearing from the shaft of the West's elevator, delivered a small stream of powdered caustic lime over the surface of each and every lump of coal passing underneath. The relief in sulphur compounds was felt at once, though only 1 per cent. of lime was introduced for the first month and a half, as it was necessary to proceed cautiously at first. The sulphur compounds, which before the partial reversion to lime purification had averaged over 40 grains per 100 cubic feet, were by this means reduced to 29 grains. To facilitate the descent of lime in the hopper, which tends to "hang up" owing to its fine powdery nature, a tapper was arranged, giving an intermittent thump to loosen the closely packed lime. This original trial apparatus has since been replaced by a more permanent machine, differing from the first one merely by being made of stronger and more durable material.

The first point that claimed particular attention was the extremely fine nature of the lime powder. The wind eddying round the coal-store blew the lime off the coal, and the retort-house was also filled with irritating dust. The effect of this from a gas-making point of view was that the liming was not carried out with regularity. On certain days the coal was better coated than on others, and the sulphur compounds varied accordingly.

To meet this state of affairs, a small quantity of steam was introduced under the rollers of the breaker; and this gave the exact effect required. The lime was fixed upon the surface of each small particle and lump of coal, giving a uniform and constant coating, and the dust trouble in the retort-house was thus entirely overcome. A further quantity of steam (small again in amount) is finally introduced in the overhead hoppers in the retort-house, which completes the fixing process.

Experiences.

By the end of July, 1910, the process was firmly established, and it was gratifying to notice that the coke suffered in no way from the small quantity of lime introduced. In the succeeding five months—August to December, 1910—the quantity of lime used averaged 2·01 per cent. of the coal carbonized, and the sulphur compounds were maintained at a steady average of 21·50 grains per 100 cubic feet. The desired object had been achieved, and an examination of the half-yearly figures showed that other advantages had been added. The yield of gas increased by 829 cubic feet per ton over the average of the past three years, during which the prescribed test-burner had been the "Metropolitan" No. 2; and the amount of sulphate of ammonia produced per ton of coal carbonized had increased by 1·88 lbs. over the average figure of the past seven years. There was, on the other hand, a slight diminution in tar produced, to the extent of nine-tenths of a gallon per ton, which was evidently more than counterbalanced by the largely increased production of gas. It can be here pointed out that of the total lime sprinkled over the coal, it is estimated that 75 per cent. is sold with the coke.

Now it is not intended in this paper to attempt to offer an explanation of these results; it is hoped that the subsequent discussion may furnish some elucidation of the changes which have been apparently produced by the carbonization of coal with a small quantity of lime, which has been evenly distributed over the surface of each particle of coal placed in the retort. Let it be said here that no change had been made in the quality of the coal used, which consisted of a mixture of half South Yorkshire and half Derbyshire—mostly unscreened coal.

Unsought Advantages.

The benefits of our liming process did not stop with the material advantages already cited. During the progress of the half year immediately succeeding the adoption of coal-liming, it became clear that certain changes were taking place in the retort-bench, which manifested themselves in a steady reduction of the draw required for the exhauster, and at the same time the nuisance from stopped pipes was becoming less and less. The pull in the exhauster-house, which up to that time had been set at 11-100ths of

an inch for ten beds of eights in action, had to be reduced to something like half the amount; and it was found in a corresponding way that the draw on the retort-bench was also reduced. This state of affairs was clearly traced to a freeing of the ascension pipes from obstruction—a welcome condition for which the retort-house staff was duly grateful. The men ascribed the cessation of stopped pipes to the use of lime, and, in default of any better explanation, that also is the only solution we can offer. The freedom in working that is now experienced, the greater comfort of the men, the higher range of carbonizing temperature at our disposal, are all benefits that have come unsought, but are none the less acceptable.

In confirmation of the immediate effect of coal-liming on the ascension pipes, I can offer one or two experiences. One of the retorts had sunk to a considerable extent; so that it was impossible to introduce the scoop of the West's manual charger. The retort had consequently to be charged by shovel. The stokers noticed that, in a house otherwise free from stopped ascension pipes, this one retort was always giving trouble. Time after time, when the retort was charged, it was necessary for the pipe jumper's arduous labour to be performed. The thoughtful stokers, realizing that the heap of coal lying on the floor for charging was not coated with lime, of their own accord sprinkled a little of the powdered lime over the charge, and, to their satisfaction and relief, stopped pipes on this retort became a thing of the past. Again, when one of the retort-houses was dropped at the end of the winter, an examination of the interior of the bench ironwork showed that there was no trace of deposit of pitchy matter and soot, such as was usually to be seen. Lastly, the converse of this condition was found when the same house was lighted up again at the commencement of this autumn. A few stopped pipes were experienced, which after a day or two's working ceased entirely, and at the same time the draw in the exhauster-house was reduced considerably below the point at which it was found necessary to work when the house was started. Mr. Cooper's claim in the eighties, that coal-liming carried with it freedom from stopped pipes, was received, perhaps naturally, with a good deal of incredulity; and though it would be unwise to predict that the same process would give equal immunity at other places—unwise because of our present complete ignorance of the forces at work—yet it seems proved to the hilt that the process has resulted in Cheltenham in an ideal state of affairs in the retort-house.

Later Confirmatory Results.

For an immediate consequence has been that carbonizing temperatures can now be adjusted to suit exactly the class of coal that is being carbonized. At last it is possible to obtain from coals, when working on a commercial scale, results as regards yield of gas which hitherto had only been obtained in the small experimental plant. The slightly higher heats which had been unattainable before last year were at our disposal when coal-liming became an established fact; and the results for the half year to June 30, 1911, show a decided advance over the previous six months. The gas made per ton was 13,407 cubic feet, an increase of 162 cubic feet over that made in the preceding period; the improved yield of ammonia was maintained; and the illuminating power was 14·98 candles, tested by the "Metropolitan" No. 2 burner, the standard being 14 candles. Lastly, but certainly not least, as it was for this that the process was first adopted, the sulphur compounds averaged 20·48 grains per 100 feet, with a consumption of lime of only 1·79 per cent. of coal carbonized.

One last point requires mention. It was stated to be an insuperable objection to Cooper's process that the limed coke caused serious corrosion of the firebars and brickwork of the furnaces; and it must be briefly stated that no trouble whatever of this kind has been experienced at Cheltenham. The clinker is quite normal, the only noticeable difference is a slight increase of dust in the flues. Close personal examination of the furnaces, and inquiries of the retort-setters, do not reveal any cause for complaint.

Let it be stated that the two retort-houses at Cheltenham contain old settings. The first setting was erected in 1883, and the others followed in rapid succession; and as these are all becoming worn out, they certainly do not afford the best working conditions. On the other hand—and these are points which may have a partial bearing on the correct explanation of what has been achieved—all the retorts are tile built, 10 feet long, with stopped ends, small charges 2¼ and 2⅜ cwt. in each house respectively, and there is no hydraulic main. These conditions have existed for many years at Cheltenham; and it may help in the elucidation of present results, if certain working figures over a considerable period before coal-liming came into operation, are presented.

Years.	Make of Gas Per Ton.	Gas Sold and Used Per Ton.	Illuminating Power.	Burner.	—
1897-1906 inclusive .	11,190	10,801	16·13	No. 1 London	
1907	12,230	11,760	15·99	No. 2 Met.	
1908	12,520	12,034	15·69	,,	
1909	12,498	12,044	14·92	,,	Lower quality coal.
1910, Jan.-June . .	12,562	12,421	14·76	,,	Lower quality coal.
1910, July-Dec. . .	13,245	12,421	15·14	,,	,,
1911, Jan.-June . .	13,407	..	14·98	,,	,,
1911, July-Oct. . .	13,603	..	15·66	,,	Higher quality coal.

The gas sold and used—in other words, "brought to book"—is given as a confirmation of the recorded make of gas. In the latter part of 1909, a lower quality of coal was used, which yielded a lower illuminating power, while the make of gas was maintained. The same mixture of coal was used up to July of this year—that is, during the introduction of coal-liming. It will be noted that concurrently with an increased yield of gas, the quality also improved. Since July, more Yorkshire coal, and less Derbyshire coal, has been carbonized; and the figures for the four months to the end of October are given. It remains to be seen how much of this will be brought to book, but there seems no doubt that it will well exceed last year's figure of 12,421 cubic feet per ton.

A review of the figures given in this paper, I submit, definitely establishes the fact that not only has coal-liming removed the stigma of "sulphury" gas in an economical and easily applied manner, but that the process has brought in its train advantages which we in Cheltenham, at any rate, would not willingly forego.

[On the table were examples of the limed coal and the resulting coke—showing that all sizes of the former were perfectly coated, and that there was about the latter nothing suggestive of the coal having been limed.]

Discussion.

The President (Mr. H. C. Head, of Winchester) said he had very much pleasure in declaring Mr. Paterson's paper open for discussion. In doing so, he should like to thank him on his (the President's) own behalf, as well as in the name of the members, for bringing forward this subject, which was one not only of very great interest, but was a very discussable one. He hoped there would be a full discussion, as there were many points that lent themselves to this purpose. There was the reduction of the sulphur compounds, the increased yield of ammonia, the lessened stoppage of ascension-pipes, and lastly, and certainly not least, the increased yield of gas. The only point on which there was any suggestion that there might be difficulty was that of coke. In the past, he believed it had been a great difficulty when using the coal-liming process to dispose of coke. He remembered seeing some years ago coke which had little white blobs of lime in it. But only a few days since Mr. Paterson showed him over the Cheltenham works; and he saw the coal-liming process at work. He examined the coke-heap very carefully; and he could assure the members there were no white blobs on the coke. The examples on the table before the members were fair representative samples of the coke. The coke question at Cheltenham had given no difficulty at all. As to the figures Mr. Paterson had quoted to them as to the make of gas, he did not think there were many in the room who did not envy them. If he could at Winchester only arrive at the point of 13,600 cubic feet per ton of coal carbonized, or somewhere near it, he should be even happier than he was at present. There were two other points he should like to mention, because Mr. Paterson had not said anything about them. The first was that when he (the President) heard of these big makes, he said "heats." He, however, saw the retorts opened, and the heats were certainly not excessive. The other possible explanation of the wickedly-minded would be "pull;" there was a level gauge in the retort-house. So that he wanted the members to feel sure that the make mentioned was really "made," and was not "obtained." He would now call upon Mr. Botley to open the discussion.

Mr. C. E. Botley (Hastings) remarked that, at the invitation of the President, he would venture to make a few remarks on the subject, which had a deep interest for him, because it reminded him of experiments that he made many years ago. Through Mr. Robert Spice, he was introduced to Professor Wanklyn, who was associated with Mr. Cooper in 1882. Professor Wanklyn then asked him if he could make some experiments at some of the works under his charge with regard to the coal-liming process, as he was anxious to be satisfied with regard to all the possibilities. Having obtained the necessary permission, he (Mr. Botley) made experiments. The claim for an increased yield of ammonia was amply sustained in every case where the experiments were made. The yield of ammonia was generally double. There was also a slight increase of the gas made per ton of coal carbonized; and a slight increase of the illuminating power. But the difficulty found then was, with the coke produced by the liming process, to maintain the heats of the retorts. It formed a flux in the furnaces, and the experiments had to be brought to an end. He had turned up, from among his relics, the instructions that Professor Wanklyn had sent him before making the experiments; and they generally agreed with what Mr. Paterson said in the early part of his paper. Professor Wanklyn wrote: "Take 56 lbs. of quicklime, slake it with 5 gallons of water, and mix the resulting slaked lime with 1 ton of coals. If practicable, run a small stream of water into the hydraulic main—viz., 10 gallons of water to each ton of coal." There were other details in the letter; but these were the sole instructions given him at the time. There was no question at all raised about the influence on the sulphur compounds. But subsequently the matter was introduced; and the results of the experiments were curious. With a coal containing 45 grains per 100 cubic feet of gas, the effect was most marked; the sulphur compounds being reduced one-half. But if a coal—a superior class of coal—only contained about 25 grains per 100 cubic feet, the effect was much reduced. Instead of the amount being less by one-half, it was only lowered by about one-third—that was to say, 27 grains of sulphur could only be reduced to about 20 grains.

This was the result of the trials he made in those days. Afterwards he tried many other experiments; but the results were always the same. Finally, as the members were aware, the process was abandoned; and, under the circumstances, he was interested to find it had been revived for the elimination of sulphur compounds. What Mr. Paterson had been able to effect in this regard was most marked, and must be highly satisfactory to him, because there was no doubt the lower they could get the sulphur compounds in the gas, the better for the consumer. It might not be inimical to health to have 40 grains of sulphur per 100 cubic feet in the gas; but to have a lower figure was better. In their case at Hastings, they were formerly under the sulphur clauses; and sanction was asked of the proprietors to participate in the Joint Bill that was promoted for the abolition of the restrictions. This Bill, it would be remembered, was successful. But his Directors then stated: "There is no intention to alter the quality or purity of the gas as at present supplied at Hastings and St. Leonards; but it is felt desirable that the Company should be relieved from the risk of vexatious and penalizing obligations which are impracticable in ordinary working, and are of no value to gas consumers." That was the policy his Company went on; and when the Bill was passed, they did not make any alterations in the system of purification for some time. But gradually they had altered it. They, however, took the sulphur test just the same every day just as they used to. The old difficulty of sulphur purification was that it wanted constant diligence and care, in order to get the boxes in right condition to be thoroughly finished; and then, the old works at Hastings being in the centre of the town, when the boxes were opened, there was a dreadful smell. Then they had to cart the spent material all through the town. They had got rid of all these difficulties. Carburetted water gas had also come in to help them considerably. They had discontinued the use of lime; and, using 25 per cent. of carburetted water gas, they kept the sulphur compounds down to an average of some 22½ grains. If Mr. Paterson was able to keep his sulphur compounds down by the use of the coal-liming process, he had succeeded in making the process eminently useful; and he (Mr. Botley) hoped that the results at Cheltenham would be confirmed by continual practice.

Mr. Charles Carpenter (London) said he must congratulate Mr. Paterson upon having so varied the original coal-liming process as to make it what it promised to be at the beginning—a success. The process, as Mr. Botley had truly reminded the members, was brought out in 1882; and from the early part of that year up to the end of June, the gas made at the Vauxhall works of the South Metropolitan Gas Company was treated wholly by the coal-liming process. At first, the lime purifiers were kept in use. But they were gradually thrown out of action; and at last the whole of the purification from sulphur compounds was performed by the Cooper process. The official limit for the Metropolis at that time, as most of those present knew, was 22 grains in the winter, and 17 grains in the summer time; and the Cooper process enabled them to keep well within these limits. For some weeks at a time, the sulphur was no higher than 7 or 8 grains; but that was exceptional, and for only a week or two, arising from some variation in the kind of coal used. But the average was below the standard requirements. In those days, there was no stoking machinery; all the work being done in the retort-house by hand. There were no coal-breakers; and when they came to think of it, it was a wonderful thing that Cooper's process did what it did under the circumstances. The 1 cwt. of slaked lime was thrown on each ton of coal; and the coal was turned over and over by stokers, and then put into the retorts. He (Mr. Carpenter) said that it was very extraordinary that, under such crude and unsatisfactory conditions, any good results were obtained. The coke, however, had a different appearance from that which had been described in the paper. There were speckles of white lime all over it; but the effect from the public point of view was that nobody complained, though the Company made a great many thousands of tons of it. The Company themselves had a little difficulty. They then had no regenerative furnaces. They only used the old-fashioned narrow furnaces; and they had a good deal more trouble when clinkering than with normal coke. The process was not continued, because it got into the hands of a somewhat unscrupulous Company; and Professor Wanklyn and his colleague (Mr. Cooper) spent a great deal of time inditing letters to the Press pointing out the wickedness of the gas companies, both in London and the Provinces, in not using a process which enabled them to supply pure gas without the disadvantage of the removal of the spent lime. It was very remarkable to consider what had been the great change that had made the unsuccessful process of 1882 the successful process of to-day. It was in those early years tried in a great many large works. Most of the London works tried it on one scale or another. It was tried in Liverpool, and in a great many provincial towns. The most notable instance was at the Tunbridge Wells Gas-Works, of which Mr. Spice was at the time Consulting Engineer; and up to the time of his death, the lime process was used there. He always spoke very highly of it. But the secret of the non-success, or partial success, of those days, he thought, was to be found in the description of the coke. If the lime were mixed with the coal in such a state of fine division that, when the coal was carbonized, they could not see pieces of lime in the solid residue, he thought this gave at once a clue to the success of the process. By the happy idea that struck Mr. Paterson of using ground lime, and in a caustic condition, he was enabled to obtain a very much finer state of division than was possible when using slaked lime in the way he (Mr. Carpenter) had described it. He thought there was no doubt the results achieved at Cheltenham must be wholly due to this cause. It was, he thought, apparent that, if they wanted, or expected, any chemical reaction to take place in the retort, they must bring the lime into intimate admixture with the coal; and the only way of doing this, it must be clear to everybody who considered it, was to use the lime in a state of fine division. The author was somewhat vague as to the amount of ammonia produced. Some experimenters had found there was an increase of 20 per cent.; at the Vauxhall works, they found there was an apparent increase in the yield of from 20 to 30 per cent. On continued working, this somehow or other disappeared. But there was one thing that he thought was due to Professor Wanklyn. He pointed out how volatile ammonia was, and how crude were the usual methods in gas-works for preventing loss of it. They had been able to prove this in all the South Metropolitan Gas-Works. The worse instance, he thought, was one where the make of liquor was about 22 gallons of 8-oz. strength per ton of coal; and it was increased—by keeping the tanks air or ammonia tight and the pipes in the same condition—up to 40 gallons per ton. Professor Wanklyn was the first person to lay stress on this. He had to find out why he did not get the increase of ammonia by the Cooper process. Professor Foster's teaching had led one to expect it would be considerable. Just why he (Mr. Carpenter) thought they were particularly indebted to Mr. Paterson was that he had appeared to have secured the success of a process which, he (Mr. Carpenter) would not say——yes, he would say, vitally affected the gas industry. As Mr. Botley had pointed out it was most important that the gas industry should keep its gas as free from sulphur as it conveniently could; and here was a process which did not depend upon any elaborate chemical plant, as did the ordinary lime purification, or any of the other processes. But it was a process that could be simply applied, and applied almost as well in the smallest works as in the largest ones. He ventured to suggest this was a matter of great importance; and it was one on which any works, however small, could experiment for itself. They would be able to ascertain whether the lime process was a suitable one for it; and if it was, it would be easy for them to apply it. He suggested they should all follow the example of Mr. Botley—that was, although they might not be under the sulphur restrictions, they should test for sulphur regularly in order to see what they really had got.

Dr. Rudolf Lessing said he had been asked just before the meeting to give a scientific or theoretical explanation of the very interesting phenomena which Mr. Paterson had observed in the application of his process. It was rather a "tall order" to expect him to proffer a full explanation of the complicated chemical and physical reactions involved. He was sure the members would excuse him if he did not go beyond a few remarks which he thought might possibly clear up some of the points, or at least suggest some lines to be followed by future investigators. He would give these simply for what they were worth. In considering the action of the lime or any other inert or mineral substance on the coal, they had to bear in mind that the position of this substance in regard to the coal was continually changing during the process of carbonization. If a layman were to view a piece of the coal exhibited by Mr. Paterson, and then take a corresponding piece of coke, and imagine that he would find on the surface of the coke some trace of the lime, he would be entirely mistaken. It had been pointed out during recent years, on several occasions, what most likely did happen to coal in the process of carbonization; and he thought that one of the stages through which the coal passed was that of the partial fusion of the coal. On heating, it partially melted, and was dissolved in some of the heavy hydrocarbons which were generated and condensed during the process. At that period of the charge the coal was therefore in a state of flux. Now it was very likely that they had to seek the action of the lime on the coal substance during this period, if any action on the coal substance took place at all, because they must consider that there were two ways in which the lime could act—the one on the coal substance; the other on the ash. There had, in fact, been proposals for liming coal quite lately. He believed that in the article on the subject in the "Journal of Gas Lighting" for October 10 reference had been made to the Diehl-Faber process; and it was stated that the lime reacted on the ash. It seemed unlikely that anything of this kind could be done; certainly not under the conditions of gas making. In this particular patented process, it was pointed out that a high temperature—a temperature much higher than was usually employed in coking or gas-making—had to be employed, in order to bring about an interaction between the lime and the silica in the ash, giving at the same time a chance for the compound formed to act on the sulphur in the coal. Personally, he did not favour this theory. He believed none of the investigators on coal had been able to produce sufficient evidence whether the ash in the coal was separate from the coal substance, or was chemically combined with the coal substance. Therefore he thought it very likely, taking the general conditions under which the limed coal went into the retort, that some relationship might be found between the lime itself and the coal substance. He believed that modern researches had shown that undoubtedly such relations must exist. Professor Bone, in the lecture he gave three years ago before the Institution of Gas Engineers, had shown the decomposition of hydrocarbons in two tubes, one of which was charged with quick lime; and it was apparent, and indeed very striking, how different

was the behaviour of the hydrocarbons when this contact substance was present from that when it was absent. So it was quite likely that the thermal decomposition of the coal substance (which, after all, was probably a very heavy hydrocarbon molecule) was similarly influenced by the presence of lime. Coming to the actual results Mr. Paterson had obtained, there again they might find some evidence as to the manner in which they were brought about. He should first of all like to refer to the high make of gas. He thought that one might give an explanation of at least one part of the increase in make. It was the water of hydration in the lime. He had just figured out that, if only a dry hydrate of lime was produced in the steaming process on top of the coal-breakers, but most likely a wet hydrate would be produced when the lime was slaked, an excess of water would be condensed by the steam.

Mr. Paterson: There is a second steaming in the coal-hoppers.

Dr. Lessing (proceeding) said that would favour all the more the theory he was putting forward, that a slaked lime compound was deposited very much of the nature of that used by Cooper and other previous workers, but more finely divided—that was to say, the slaked lime alone would contain an excess of water; it would contain at least 25 per cent. of water of hydration, gained by the conversion of CaO into Ca $(OH)_2$. Two per cent. of lime being added to the coal, the water represented upwards of 0·5 per cent. of the coal charged. This water undoubtedly must favour the production of some water gas; but even then it was not like water sprinkled over the coal which would evaporate at the first attack of the heat. It was a chemically combined water; and as they all knew, it could only be driven off at higher temperature. The inference would be that, during the period of fusing or softening of the coal, the hydrate of lime would be preserved from decomposition for a certain time. During the time the coal was drying the more volatile hydrocarbons were driven off; and subsequently the dehydration of lime took place—the water vapour liberated acting on the coke, thereby forming water gas. It would be a most efficient process of water-gas formation, since the steam was very intimately mixed with the coal substance itself. He did not know if there was anything in this theory; but he thought it might be partially responsible for the increase in make. Some points might be raised with regard to the absence of stopped pipes. The stoppage of the pipes was entirely due to the secondary decomposition of hydrocarbons. The sensible heat of the gas leaving the retorts had only time to act during the period it was in the ascension-pipes. Then a thermal action took place, and led to the decomposition of some of the tar and heavy hydrocarbons. If some such decomposition had taken place before, under the influence of the lime, it was likely that the secondary decomposition would be prevented. One explanation of the increase in make might be found in a suggestion made by Mr. Paterson himself. He said that, on account of the advantages gained by the application of lime, he had been able to adjust his temperatures more minutely and more efficiently to the kind of coal he was carbonizing. In other words, the coal which required the higher temperature could have the higher temperature without the danger of the ascension pipes getting stopped. Therefore it was quite likely that the regulation of the temperature alone might be responsible for approaching the maximum make with one or the other kind of coal. With regard to the clinker, he had not the slightest hesitation in saying that 2 per cent. of lime added to practically any coal or coke must have some bearing on the clinker. Lime was a flux. Two per cent. on the coal amounted to, roughly, 20 per cent. on the ash, assuming the latter as high as 10 per cent. in the coal. This must show itself unmistakably, provided the lime came in contact with the ash itself. Now Mr. Paterson had made the observation that the fire-bars were kept clean, but that there was some slight trouble with dust in the flues. This went to prove his (Dr. Lessing's) assumption that the lime was not in contact with the ash, but was embedded in the coal substance by itself. And the moment the coke was burned, the lime which had been added would be free in its original form—practically in the form of dust, carried away from the ash, and therefore the ash would not have a chance to obtain the additional flux; and it would be kept at the higher refractory condition in which it was present in the original coal. With regard to the sulphur, he thought that for anyone who was going into the subject from a purely scientific point of view, it would be most important to establish a sulphur balance. He should like to know whether Mr. Paterson had any evidence of whether the sulphur in the coke was increased or decreased. It did not necessarily follow that a decrease of the sulphur compounds meant an increase of the fixation of the sulphur in the coke. He had only recently had a case to look into from the colliery point of view, in which the washing of coal free from pyrites was concerned; and it was a very "tricky" subject to find out whether a decrease of the mineral sulphur itself meant an increase of sulphur in the coal substance. The sulphur might simply go forward in the system in the shape of sulphuretted hydrogen, and had no chance of forming carbon bisulphide. And if it had, it would be broken up again by means of the lime as a catalytic agent. However, a sulphur balance would demonstrate how much sulphur was in the original coal, how much came out of it in the form of sulphuretted hydrogen and sulphur compounds in gas, tar, and liquor, and how much was left in the coke. This would pretty clearly show what the prevailing conditions were. He should like to add the expression of his sincere appreciation of the most interesting paper Mr. Paterson had given them.

Mr. W. B. Randall (Waltham Cross) congratulated the author upon his courage in resurrecting such a subject, as he had claimed even more than the original inventors had done in the matter of an increase in the make of gas to the extent of 829 cubic feet per ton of coal carbonized. He understood this was the claim in the paper; but he was rather doubtful on reading it whether it was a distinct claim for the coal-liming process, or whether it was only ancillary or secondary, because they had been able to keep clear of stopped pipes at Cheltenham, and so were getting the increased make of 829 cubic feet. It occurred to him (Mr. Randall) that if Mr. Paterson really made this claim it could be easy of substantiation. Probably he had substantiated it by ceasing the use of lime (say) for a week or a fortnight, and seeing whether or not the make dropped by 829 cubic feet. He should like to know with regard to the charge what was the duration of carbonization?

Mr. Paterson: Four hours forty-eight minutes.

Mr. Randall: Is carburetted water gas manufactured?

Mr. Paterson: Only, according to Dr. Lessing, in the retorts. (Laughter.)

Mr. Randall (continuing) said the author did not mention whether there had been any correction for normal temperature and pressure. During the past summer, it turned out in his own case, to his surprise, that they had made considerably over 14,000 cubic feet of gas per ton of coal carbonized; and he wondered whether the season had had anything to do with it, owing to the high temperatures of the atmosphere. He corresponded with an engineer who made monthly corrections for temperature and pressure. He found that in the Michaelmas quarter of 1909, there was a difference of 0·88 per cent. to be met; in 1910, 0·74 per cent.; and in the past quarter, 3·59 per cent. So he thought if Mr. Paterson allowed that, it would help to bring out the make mentioned in the last table. However, the point might be worth Mr. Paterson's consideration. Would he mind telling the members the price he paid for the ground lime; and the percentage of calcium oxide in it? He did not think this was mentioned in the paper. Another matter was, had Mr. Paterson had any trouble with regard to naphthalene with these makes of gas; or did the coal-liming process carry any charm in its roll of merits in reducing naphthalene?

Mr. T. E. Pye (Chichester) said there were one or two questions that were particularly interesting to him. One had reference to welding. He was connected with a works years ago which was experimenting with the Cooper process; and at that time there was great trouble with a large firm, Messrs. Henry Wood and Co., who were considerable Admiralty contractors for the manufacture of cables and anchors. They on one occasion sent down to the gas-works, and asked someone to inspect some of their work with which they were dissatisfied. It was found that they were using the coke from the limed coal; and that it was impossible for them to get satisfactory welding. They had heard Dr. Lessing give some interesting explanations concerning the process; and he thought that probably the explanation might be found in the suggestions the Doctor had furnished. He was sure, however, they would be glad to hear Mr. Paterson's view on this point, because, to companies supplying coke for such a purpose as the one he mentioned, it was a very serious thing indeed. The only other question had reference to carbonic acid. In the judgment of the author of the paper, was it probable the increased illuminating power was due to considerable absorption of carbonic acid, which without the lime would not be taken up at all?

Mr. D. H. Helps (Reading) asked whether the author thought they would learn anything that would be valuable of what was going on in the retort if they added an excess of lime to the coal, and then in some way washed out the lime to see whether it had combined as sulphate of lime. There was no doubt Mr. Paterson had been able, perhaps in some scientific way, to obtain better results than were realized in the 'Eighties. He (Mr. Helps) had questioned some of the old stokers at Reading on the subject, and they told him that Mr. Baker tried the process about 1888; but he (Mr. Helps) could not ascertain what the results were. One of the stokers he questioned, however, told him they never used the coke from the limed coal for feeding the furnaces. He should like Dr. Lessing to tell them whether they could get any information by going to the extreme in liming, as he had suggested.

Dr. Lessing said he thought the suggestion a valuable one. By going to the extreme limit in adding lime, one ought to find out something about its action. Even without this, however, he thought it was possible, by analyzing the coke itself, to find out whether there was any increase of alkalinity in the coke, and whether or not the lime was in a free condition.

Mr. Helps: Would it form sulphate of lime?

Dr. Lessing: Undoubtedly it would. You have to consider the temperatures are very high, and are likely to decompose any sulphur salts that have been formed.

Mr. Carpenter: Has Mr. Paterson experienced any difficulty in regard to the extra reek arising from the coke after it is quenched? We found there was a distinct reek of sulphuretted hydrogen given off when the coke produced from the limed coal was quenched.

Mr. Paterson, in reply, said he must thank the members very much for the kind way they had received his paper. He must, however, beg of them to remember he was only the scribe in this matter. His father conceived the idea of using the powdered lime in this way; and he knew the members would agree with him that to the author of the process as a process the honour was due, and not to the man who subsequently entered into and worked it.

He wished to make this quite clear. It was in operation when he got to Cheltenham on his transference from Redhill—being then on (as it were) its baby legs. But he had it under his charge in the matter of working. There it was; there he found it; and there it would remain for some time yet. Taking up some of the points raised, if he might be allowed to refer first to Mr. Carpenter's last question. They had not noticed any extra smell or reek of any kind when the coke was being quenched. Whether their noses were less sensitive than in the 'Eighties, he did not know. But they had looked out in the technical record for this point, but it did not appear. He was glad to have Mr. Botley's appreciation of the results. He certainly confirmed the figures for the reduction of the sulphur compounds from his own experience in the 'Eighties using Cooper's process. Mr. Carpenter raised a point on the subject of ammonia production. He (Mr. Paterson) understood him to say this was only referred to vaguely in the paper; but he thought he could supplement the reference a little by recounting the figures. Early in the paper he said they found an increase of 1·88 lbs. of ammonia per ton of coal carbonized over the average figures for the previous seven years—that was to say, for the seven years preceding the use of lime they were averaging something like 24 lbs. to the ton of coal; and when coal-liming was introduced the succeeding half year, they had an increase of 1·88 lbs., or something like 25·88 lbs. of sulphate of ammonia to the ton of coal. This was an increase of nearly 2 lbs.

Mr. Carpenter: Was that figure subsequently maintained?

Mr. Paterson said it was. The increase was not, of course, as much as Cooper claimed; but those were the actual figures that had been obtained at Cheltenham. Then he came to Dr. Lessing's valuable contribution to the discussion. He knew Dr. Lessing would not expect him, at such short notice, to offer a serious comment on his remarks, because they were the outcome of a trained mind directed to a difficult subject. But let him try to take up the point as to the water of hydration of the lime. He thought it was quite clear when Dr. Lessing spoke that the lime was hydrated at the coke-breaker; and later on in the overhead coal-hoppers in the retort-house a further quantity of steam was introduced. It was only a small quantity, but still a further amount of steam was introduced. This completed the fixation of the lime upon the coal, and, of course, it prevented any possible trouble of dust flying about the house. Still the additional steaming did make the coal at this point slightly moist. The lime was more than slaked; it was slightly moist. Dr. Lessing suggests that when the coal got into the retort, there might be some formation of water gas, and that this would be a partial solution of the increased yield of gas. He (Mr. Paterson) did not quite subscribe to this theory. It was admittedly an attempt to explain the increased yield; but he did not think he would like to say he was convinced that this was the cause, as Dr. Lessing suggested, when the amount of heat was sufficient to drive off the water of hydration of lime to reduce it to the oxide. Perhaps Dr. Lessing could tell them the temperature at which this would take place.

Dr. Lessing: I believe it is between 200° and 400°.

Mr. Paterson (continuing) said supposing they took it at 400° or 500°, he was inclined to think that the first action of the heat of the retort upon the lime was to dehydrate it again before ever the state of flux commenced to which Dr. Lessing had referred. He did not know this was very pertinent to the point; but his own belief was that the lime was dehydrated before any reaction took place.

Dr. Lessing: Is it not only the drying off of the excess of water?

Mr. Paterson: In the first place that is so. After that, I would suggest the taking away of the H_2O from the slaked lime, and reducing it to the oxide.

Dr. Lessing: By that time there may be only the hot coke to act upon.

Mr. Paterson said he did not think they would have the coke so soon to act upon. He, however, was glad to have the suggestion; and if they could investigate it further, it should be done. It was an honest attempt to provide them with the solution; and they had asked for help in this direction. With reference to stopped pipes, he thought Dr. Lessing suggested a possible explanation in the avoidance of the secondary decomposition of the gas that took place. Of course, it must amount to that. He did not quite follow what was meant in regard to decomposition.

Dr. Lessing: The lime should bring about the primary decomposition during the decomposition of the coal itself, before the volatile substance is out of it.

Mr. Paterson said undoubtedly the stopped pipes were freed; and he thought Dr. Lessing had stated in so many words what did happen; and there they must leave it for the present. In the paper he spoke of one case where the stopped pipes were freed by sprinkling lime on the coal for shovel-charging one retort. This lime was not hydrated. There was caustic lime shovelled on to the coal without any water; and yet the stopped pipes ceased on the retort. Then Dr. Lessing's remarks with regard to the dust in the flue were very clear indeed. He suggested that the lime went forward into the flues without having come in contact with the ash at all. Perhaps they might analyze the flue dust for lime; and a sulphur balance would give them a solution of the reduction of sulphur compounds. They must endeavour to obtain this sulphur balance. There was every possibility that carbon disulphide was not produced at all. Probably, as Dr. Lessing suggested, the presence of the lime prevented the formation of carbon disulphide; and the sulphur either remained in the ash or went forward as sulphuretted hydrogen. But at Cheltenham they seemed to get a fractional reduction of sulphuretted hydrogen in the crude gas going forward to the purifiers—he would say a reduction of 0·1 per cent. as an average figure. For a period of twelve months now from the time the process was started, they got a fractional diminution of sulphuretted hydrogen going forward.

Dr. Lessing: That would not affect the point as to the reduction of the carbon disulphide.

Mr. Paterson (continuing) said that Mr. Randall questioned him as to whether they claimed 829 cubic feet additional make as a direct result of the utilization of lime in carbonization. They did. He did not think the patentees claimed it as part of the invention; but the experience at Cheltenham had been that the introduction of the limed coal in the retort had resulted in an increased yield of gas to the amount of 829 cubic feet. This, it would be seen, was obtained in a certain period during which there was absolutely no change made in the working temperatures of the retorts. Subsequently they did raise the heats, because they found they could do so without the recurring trouble of stopped pipes; and there was a further increase on the 829 cubic feet already obtained as the direct result of liming (so far as could be seen) without increase of carbonizing temperature. In regard to the temperature and pressure at which the gas was measured, they did not correct for it. They simply took the station meter at normal temperature of the atmosphere whatever it might be, and let the barometer just take what care it could of itself. This was not a practice that was followed universally. But it had been their practice at Cheltenham; and at the end of a twelvemonth, they could give definite figures. Twelve months compared with another twelve months would furnish comparable figures. However, the hot summer had no doubt resulted in high temperatures in the station-meter house; and so perhaps some of the make must be corrected down to that. They must endeavour to supply correct figures at the end of twelve months. He might say in connection with this that the gas paid for—that was, the amount of gas that passed through the consumers' meters for the nine months ending with the September quarter—amounted to something like 13,000 cubic feet per ton of coal carbonized. "That was paid for, Mr. Randall;" so that temperature and barometrical pressure did not come into that at all. As to the price of the lime, they paid 13s. for shell lime, and ground it themselves. Figures were quoted in the article that appeared in the "Journal" for Oct. 10, which showed that the total cost of preparing the ground lime and placing it in the hopper over the breaker amounted in their case to 3½d. per ton. They could reduce the cost of it considerably by using an improved mill for the grinding of the lime. They had so far only employed an old mortar mill. As to the lime used, they had experimented with several classes; but they found they got similar results whatever lime was tried. He could not tell the percentage of calcium oxide; but it was pretty pure lime—lime from the Cotswold Hills—and they took care to get it well burnt. As to naphthalene, he could not offer any definite figures. They had had naphthalene troubles at Cheltenham; and they were now trying Mr. Botley's process for the solution of the naphthalene difficulty. They were better now than they were a couple of years ago; but they were not yet free of the naphthalene trouble. At the same time, they had not noticed any marked increase since introducing coal-liming. They did not find any special connection between naphthalene in the consumers' services, or in the mains, and their process. Mr. Pye asked him for information as to the use of the coke from limed coal for welding. He could not go any further than this, that they had no trouble in their own smiths' shop, and they had found no trouble there in their ordinary operations. He could not ascribe any increase of illuminating power to the abstraction of carbon dioxide. He was sorry the point had not been taken up; but he could not agree it was the cause of the increased illuminating power. They had certainly obtained it with similar coals before and after coal-liming commenced. He thanked the members for their kind reception of the paper; and he hoped that time would give further explanations of what had certainly become to them at Cheltenham a remarkable state of affairs in the retort-house.

Two-Cycle Engines.—This was the subject of a paper read by Mr. R. W. A. Brewer, Assoc.M.Inst.C.E., at the meeting of the Society of Engineers on Monday last week. The author referred to the early work of Mr. Dugald Clerk upon the two-cycle engine, and drew attention to the system of subdividing the charging side of the engine into two separate portions—an air-pump and a fuel-pump. Touching on the advantages of the two-cycle engine compared with the four-cycle, he stated that they were more theoretical than actual as regards power development for size of engine; but the absence of exhaust-valves on the former was a very substantial point in its favour. Having described some of the more modern engines, the author turned to a consideration of the thermal efficiency of the two and four cycle types, and pointed out that there was very little difference between them. But he said the carburation in the former presented considerable difficulties; it being found in practice that excessive precipitation of fuel sometimes took place in the pump cylinders, thus accounting for loss on the admission side. In conclusion, he referred to the great possibilities of the two-cycle engine; but he admitted that much remained to be done before it displaced the four-cycle one.

SMOKE ABATEMENT EXHIBITION AT MANCHESTER.

Gas Industry's Part in the Campaign.

[From Our Manchester Correspondent.]

At the Manchester and Salford Smoke Abatement Exhibition, which opened on Friday afternoon, in the City Exhibition Hall, Manchester, the gas industry is well and strongly represented. As a matter of fact, in regard to the number of exhibits, it plays a more prominent part in this demonstration of what can be done for smoke prevention than does any other section—electricity coming second. The promoters of the exhibition have been fortunate in securing the active support of the Gas and Electricity Committees of the Manchester and Salford Corporations; while the authorities in neighbouring towns—even in places outside the county—have rendered useful help in making the venture a success. The Special Advisory Committee included such men as Councillor W. Kay (the Chairman of the Manchester Gas Committee), Mr. J. G. Newbigging, M.Inst.C.E. (the Chief Engineer of the Manchester Gas-Works), Alderman Phillips (the Chairman of the Salford Corporation Gas Committee), Mr. W. W. Woodward (the Salford Gas Engineer), Mr. W. Whatmough (the Gas Engineer to the Heywood Corporation), Mr. H. Kendrick (the Engineer to the Stretford Gas Company), Mr. W. Prince (the Gas Engineer at Stoke-on-Trent), Professor Smithells, F.R.S. (of Leeds University, and President of the Society of British Gas Industries), Sir Alfred Hopkinson, K.C., M.A. (of Manchester University), and the Electrical Engineers to the Manchester and Salford Corporations. As an evidence of the interest of the authorities in the exhibition, it may be mentioned that they, together with the firms represented, have taken something like a million admission tickets for distribution among consumers and customers; a great proportion of these being for free admission to the hall, and the others entitling holders to visit the exhibition for 3d.—one-half the usual charge.

It has been said, and with a good deal of truth, that, had the exhibition been given some other name, it would have been likely to attract the general public in larger numbers than seems at present possible. The title "Smoke Abatement," for some reason or another, does not appeal to many of the citizens, who are inclined to look upon the subject with a great deal of indifference. However, much is being done, by way of advertisement and otherwise, to stimulate public opinion on the question of the economies and hygiene of smoke prevention; and at the exhibition may be seen all the latest improvements and devices in gas and electricity for domestic and power purposes—there being also periodical demonstrations in cookery by gas and electricity.

There are a great variety of gas cookers and fires; and exceptional facilities are offered the public to place orders with the firms exhibiting and to have the goods fixed up at home by the Corporation or the Gas Company, as the case may be. This seems certain to be one of the most productive sections of the exhibition; the orders already placed in regard to gas-fires being regarded as highly satisfactory. Now that the Manchester Corporation have decided to supply and fix gas-fires on simple hire, or on the three years' hire-purchase system, a fillip has been given to business in this line; and those in charge of the Gas Department are making full use of the exhibition to still further increase the demand for this article—thereby helping to alleviate the smoke evil, and at the same time increase the sale of gas. If it be true that 60 per cent. of the smoke of the city comes from the ordinary coal-fire, then the reformers have a wide field before them in educating the public to the wisdom of having their houses equipped with all the latest appliances for lighting, heating, and cooking by gas. In this, they are assured of the hearty support of the Gas Committee. If gas-fires can be made popular, the exhibition offers variety enough in the display made of this method of heating and labour saving. Since the last Gas Exhibition in Manchester, some years ago, great improvements have been made in the construction of gas-fires, as the result of scientific investigation; and the models to be seen at the present exhibition are calculated to remove much of the distrust with which the public have hitherto viewed the gas-fire. As one authority put it, those responsible for the management of gas undertakings, as well as the manufacturers, welcome this opportunity of demonstrating to the public in Lancashire and the adjoining counties the fact that, whatever truth there may have been in the objections put forward as regards gas-fires of the old school, those on modern lines can be used to replace coal-fires entirely for all-day use, with all the advantages of the coal-fire and none of its drawbacks, and with other important advantages peculiarly their own. Most of the models shown in action at the exhibition are heated up equally, and so designed that the whole of the heat units in the gas are accounted for.

GAS A REMEDY FOR THE SMOKE NUISANCE.

In the official catalogue of the exhibition appears an interesting article by Mr. J. G. Newbigging, M.Inst.C.E., the Chief Engineer to the Manchester Corporation Gas Department. Having referred to the prominence of the gas industry in the exhibition, rendering a few words on the economies and utility of gas of special appropriateness, he says:

The gas supply of large towns is destined in the future to play a greater part in the solution of the smoke problem than it has hitherto done, if every advantage is taken of up-to-date methods of manufacture, and sound commercial principles adopted in its management, in order that the selling price may be reduced and maintained at a low figure. Under these conditions, it should not be difficult in all large industrial centres to sell gas at a price not exceeding an average of 1s. 9d. to 2s. per 1000 cubic feet, provided that in the case of corporation gas undertakings they are not unduly handicapped by being called upon to contribute excessive sums in aid of rates.

It is obvious that the effect of a low selling price is to largely extend the use of gas for other purposes than lighting; and seeing that the field of lighting is now divided between gas and electricity, it is of special importance that gas should be allowed to extend its operations unfettered. The advantages of a cheap supply of gaseous fuel in a district like Manchester, in promoting its healthfulness and cleanliness, have not hitherto been duly appreciated at their full value. On the authority of the Right Hon. John Burns, M.P., the increasing use of gas apparatus for heating, cooking, and motive power in the Metropolis in recent years has had a beneficial effect on the atmosphere; and, in his opinion, as well as in the opinion of other authorities, it is in the increased use of gas that the main solution of the smoke problem must be looked for. The London Gas Companies, by selling gas at a low price as compared with the price of solid fuel in their districts of supply, are fixing thousands of cooking-stoves, gas-fires, and other gas-consuming appliances every week; and there is no reason why this satisfactory state of things should not prevail in every large town throughout the United Kingdom—as, indeed, it already does in towns where the selling price of gas is reasonable, and facilities are given to the consumers to obtain gas-consuming appliances on easy terms.

Lighting.

In spite of the keen competition with electricity, gas has, by the aid of the incandescent mantle, firmly established itself as an economical medium for lighting. With gas at 2s. 3d. per 1000 cubic feet (the present price in Manchester), a light of 1000 candles can be obtained at a cost of less than 1½d. per hour, including the cost of maintaining the burners and mantles in good condition, which compares more than favourably with any other system of artificial lighting. It is sometimes asserted by those whose interest it is to decry the use of gas for domestic lighting, that the heat given off by an incandescent burner is objectionable. The contrary is the truth, because it must be remembered that something like 70 per cent. of gas for lighting is consumed during the cold, damp months of the year, October to March, when a little additional warmth to that of the ordinary fire is, in the words of the well-known advertisement, "grateful and comforting." A certain amount of heat is, indeed, an absolute essential of perfect artificial lighting, in order to keep the air of the room in circulation, and assist ventilation and prevent cold draughts of air.

In the sphere of street and shop-window lighting, high-pressure gas, of which there is an available supply in many large towns, has become firmly established in public favour. For cheapness, steadiness, and penetrating power it is unsurpassed; and, light for light, high-pressure gas is about one-half the cost of low-pressure gas.

Cooking.

The modern gas-cooker is an indispensable adjunct to every household; and its convenience, economy, and efficiency for cooking the nation's food are now so generally recognized that little new can be said in its favour. It is estimated that there are considerably over two million gas-cookers in use in the United Kingdom at the present time, and this number is being added to every year; so that a large proportion of the inhabitants have realized the advantages of cooking by gas. From actual experiments made in the case of a household of six persons, with gas at 2s. 3d. per 1000 cubic feet, the year's bill for gas used for cooking and for boiling water for general purposes in the summer months, when there was no fire, worked out to nine-tenths of a penny per person per week. The question of economy in food cooked by gas—that is, the yield of meat cooked in gas and coal ranges respectively—is an important consideration. The late Dr. Stevenson Macadam, of Edinburgh University, carried out numerous experiments in this direction, and found that a given weight of raw meat yielded, when cooked in a gas-cooker, 15 per cent. more cooked meat than did a coal-range; the difference being due mainly to the fact that the juices of the meat are more thoroughly retained. By simply turning a tap and applying a light, the cooker is ready for operation; and the uniformity of heat, cleanliness of the fuel, and absolute control, render the gas-cooker the most perfect and economical of cooking appliances.

In some towns, no charge is made for the use of gas-cookers; in others, a merely nominal rental is charged. The Manchester Corporation Gas Department have been to the forefront of gas undertakings throughout the country in giving the consumers the free use of gas-cookers. The effect of this concession is to save the consumers a sum equivalent in most cases to a reduction of 3d. per 1000 cubic feet for gas used for cooking purposes. Further than this, the 54,000 cookers in use in Manchester at the present

time have replaced at least 60,000 tons of solid fuel per annum, which would have been continued to be used in open fires, polluting the atmosphere, buildings, and streets with smoke and dirt.

HEATING.

The gas-fire is an appliance which is rapidly winning its way in public favour; and this is not surprising, when it is realized what a large amount of thought and care have been given to its scientific construction in recent years, largely through the educating influence of the Chair of Fuel and Gas Engineering, founded at the Leeds University by the gas industry. The question is often asked whether gas-fires are a healthy method of warming a room. So long as the heat from a gas-fire is mainly radiant heat and low-temperature convected heat, there is nothing in their use prejudicial to health; and the manufacturers of these fires, who employ scientists of high standard, have brought them to a high state of perfection. In modern gas-fires, ample provision is made for taking away all the products of combustion, and at the same time assisting in the ventilation of the room. The fact that gas-fires are now largely used by the medical profession in their own homes and in hospitals, should be sufficient to remove any prejudice to their greatly extended use; and a Special Commission recently appointed by the "Lancet" to investigate the use of gaseous fuel from a hygienic point of view reported strongly in its favour. For economical intermittent heating, the gas-fire is not excelled by any other system; and the avoidance of dirt and damage to furniture and carpets, with the saving in labour by displacing solid fuel, have only to be experienced to be fully appreciated.

The Manchester Corporation Gas Department have now adopted the system of fixing gas-fires free of charge, and keeping them in perfect working order at a small annual charge; and there is no doubt that in a very short time the quantity of solid fuel displaced by gaseous fuel for heating in Manchester will exceed that displaced by the gas-cooker, to the general advantage of the city. The types and sizes of fires let out on hire can be inspected at the exhibition, and are of suitable shape and design to suit any apartment of a house. The smaller size costs for gas consumed ½d. per hour, the medium size ¾d., and the larger size 1d.

The increasing use of gaseous fuel for industrial purposes during recent years has been most marked; and this is not surprising, when it is realized that from its use the maximum of work can be obtained with a minimum of time and labour, and that it can be at once turned off when not required, resulting in economy. In short, we have in ordinary town's gas a fuel at our command which, with proper appliances, will do perfectly, economically, and without nuisance, all heating in domestic service, including fires, cooking, bath-heating, washing, ironing, clothes-drying, &c.; while for workshop use, it is unequalled by any other fuel.

One has only to walk through the streets of Manchester on any Sunday, when the use of solid fuel for industrial purposes and the heating of offices is discontinued, and notice the clearness of the atmosphere, to realize that these conditions could be attained every day by the general use of gaseous fuel. Every 1000 cubic feet of gas consumed for purposes other than lighting will bring the city nearer to relief from the thraldom of smoke, and effect economies in our natural resources of heat and power; and it is our duty to encourage in every way its extended use.

The Opening Ceremony.

At the inaugural ceremony, which took place in the afternoon, there was on the platform a very large gathering representative of the Smoke Abatement League, the Manchester and Salford Corporations and neighbouring authorities, and the gas and electrical engineering undertakings of the chief Lancashire towns. Alderman H. LINSLEY, the Mayor of Salford, occupied the chair, and those present included the Lord Mayor of Manchester (Councillor S. W. Royse), who was announced to perform the formal opening ceremony, Councillor W. Kay, Chairman of the Gas Committee, Professor John W. Graham, M.A., Chairman of the Smoke Abatement League of Great Britain, Mr. J. G. Newbigging, M.Inst.C.E., Chief Engineer of the Corporation Gas Department, Mr. W. W. Woodward, Gas Engineer to the Salford Corporation, Councillor James Kendall, J.P., Hon. Secretary to the Manchester and Salford Smoke Abatement Society and of the Exhibition, Mr. Tim Duxbury (Oldham), Mr. Samuel Glover (St. Helens), Mr. Isaac Carr (Widnes), Mr. W. Whatmough (Heywood), Mr. J. H. Crowther (Wallasey), Councillor Eastwood, (Chairman of the Wallasey Gas Committee), Mr. T. Duxbury (Manchester and Darwen), Mr. Arther Andrew (Oldham), Mr. Charles Potts (Hyde), Mr. J. E. Lamb (Altrincham), and Mr. William Hill (Stalybridge).

THE LATE ALDERMAN ROBERT GIBSON.

Councillor KENDALL, at the outset, said it was with deep regret that he, on behalf of the Smoke Abatement League, had to announce the death of a gentleman who took a deep interest in the promotion of the exhibition, and one who had looked forward with great anticipation to occupying the chair at the opening. He referred to the late Alderman Robert Gibson, the Chairman of the Gas Committee of the Manchester Corporation. In his place, they had Alderman Linsley, the newly-elected Mayor of Salford, to preside.

THE VALUE OF THE EXHIBITION.

Alderman LINSLEY, having acknowledged the compliment paid him, said it seemed to him almost a scandal that with the many smoke abatement appliances they now had on the market there was so large an emission of smoke in cities and towns. He was glad to find that health committees of corporations had done much to lessen the death-rate by the removal of slum properties and the improvement of sanitary arrangements; and it was for gas and electricity committees to help on the good work by seeing to it that there was a greater application of gas and electricity for cooking and heating, and in particular for power purposes, so that there would be a purer atmosphere. This could be done by the cheapening of gas and electricity, so that people would almost be compelled to use them in preference to coal. He would go even further, and say that, if municipalities were to supply gas and electricity even at a slight loss from a financial point of view, it would be more than compensated for by the gain there would be from the improved health of the people.

The LORD MAYOR OF MANCHESTER, on being called upon to formally declare the exhibition open, remarked that during the last five to ten years enormous progress had been made in the application of gas and electricity, not only for domestic purposes but also for power. The machinery in many large works was now driven by gas and electricity; and he was confident that, as further progress was made in this direction, it would not only be to the advantage of the users, but of great benefit to the people through having a clearer atmosphere. He was glad to see that the Gas Committee of the Manchester Corporation had taken an enlightened view of the question of supplying gas at a cheaper rate for power purposes, and in an endeavour to induce people to use gas-fires instead of the ordinary coal-fires. The one great point was to bring the charge for gas down to such a figure as to compete successfully with coal. The more extended use of gas and electricity for heating, cooking, and power meant a clearer atmosphere in cities and towns, and better health for the inhabitants. It was his hope that people would attend the exhibition in large numbers, and see for themselves the advantages to be gained by a greater application of gas or electricity for heating, cooking, and power purposes in their various localities.

Councillor W. KAY (Chairman of the Manchester Gas Committee), in proposing a vote of thanks to the Lord Mayor, expressed the opinion that the exhibition would do much to educate the people as to the possibilities of gas and electricity to reduce the smoke evil.

Councillor GEORGE HOWARTH (Chairman of the Manchester Electricity Committee) seconded the proposition. He said that in Manchester they were doing their share in the smoke abatement campaign by endeavouring to supply gas and current at the lowest possible price. The greater utilization of gas and electricity as a means of reducing the smoke evil depended in a large measure upon the public themselves; and he was hopeful for the future. The exhibition was a practical one, to show what could be, and what would have to be, done. Competition was so keen in business nowadays that people could not afford to throw away anything that would be of use in lessening the cost of light and power; and in these respects much could be claimed for electricity as well as gas.

Councillor MARGARET ASHTON, having been called upon to support the motion, said she knew that there was a great deal to be accomplished in a wider use of gas for domestic purposes For some time she had been trying to devise a scheme whereby the family wash might be done by a small gas-engine, so that this work should not make the home miserable for two long days in our wretched climate. What was more, she would like to see gas used for the drying of clothes, and for a great many other domestic operations which were now performed laboriously by hand. In England we did not seem to make the progress they did in America in the use of gas and electricity for domestic purposes. How much of this was due to the lack of appreciation on the part of the public she did not know; but as long as she was a member of the City Council the greater use of gas and electricity in the direction she had indicated would have her close attention.

The resolution having been carried,

Alderman JAMES FILDES, J.P. (Chairman of the Manchester Sanitary Committee), proposed a vote of thanks to the Chairman for his services. He expressed the hope that the Mayor of Salford, along with the Lord Mayor of Manchester and the Chairmen of the respective Gas and Electricity Committees, would constitute themselves champions in this crusade for an abatement of the smoke nuisance, and help thereby to bring about a more healthy condition for the citizens in both places.

Alderman T. H. JENKINS, J.P. (Salford), in a few words, seconded the motion.

Professor GRAHAM, in supporting the motion, said he had great hopes that the exhibition would be the means of bringing about a much greater use of gas and electricity for heating and power purposes than was the case at present; thereby purifying the atmosphere, and making Manchester and district much pleasanter to live in.

The MAYOR OF SALFORD having responded, the inaugural proceedings concluded.

Among the Exhibitors.

The Exhibition Hall is brilliantly illuminated at night; the Gas and Electricity Departments of the Corporation being in friendly rivalry in this respect. The Keith-Blackman high-pressure gas installation includes four 3000-candle power lamps; and those of the Electricity Department are similar in type and power to those with which they are now experimenting in the central thoroughfares of the city, in competition with the high-pressure gas-lamps fixed by the Gas Department for test purposes. Then it is almost needless to say that the different stands are, as a rule, well lighted. In some cases near to the entrance a freer use of gas would certainly improve matters—that is to say, bring them more into line with the others as regards illumination. The general arrangement of the exhibition leaves little to be desired, save, perhaps, that the gas fire and stove manufacturers would have been better able to show off their products to the public had they not been crowded together at one end of the hall, and been given a little more space in the passage way to accommodate the crowds of people inspecting the appliances and hearing from the attendants the merits of the several exhibits. There are about ninety stands on the ground floor, and a few in the gallery; and some firms have more stands than one. The following list shows at a glance the

exhibitors connected with the gas and allied industries, additional particulars as to some of their exhibits being given later on :—

Arden Hill and Co., Aston, Birmingham—gas-stoves.
Auto-Lighter, Limited, Westminster, London, S.W.—automatic gas-lighting systems.
Bray and Co., Limited, Leeds—gas lighting appliances.
Cannon Iron Foundries, Limited, Bilston, Staffs—gas-stoves.
Carron Company, Stirlingshire—gas-stoves, &c.
Clark's Syphon Stove Company, Limited, Warrington—patent gas toasters, radiators, &c.
Coalexld, Limited, Lancaster—smokeless fuel, &c.
Davis Gas-Stove Company, Limited, Luton—gas stoves, fires, &c.
Ferrybridge Foundry Company, Limited—cooking ranges, stoves.
Fletcher, Russell, and Co., Limited, Warrington—gas fires, stoves, radiators, &c.
Keith and Blackman Company, Limited, Manchester—high-pressure gas lighting.
Main, R. & A., Limited, Falkirk—gas fires, stoves, &c.
Macpherson, Donald, and Co., Manchester—metallic oxide paints.
Nawell, F. D., Manchester—patent fire-grates.
Northern Heating Company, Liverpool—stoves.
"Ovee" Light Company, Manchester—gas heaters, lamps, incandescent mantles, &c.
Parkinson Stove Company, Limited, Birmingham—gas fires, stoves, radiators, geysers, &c.
Ramie Company, Limited, Stockport—incandescent mantles.
Richmond Gas Stove and Meter Company, Limited, London—gas fires, stoves, radiators, &c.
Rotary Meter Company, Manchester—patent cash gas-meter.
Smith and Wellstood, Limited, Bonnybridge—stoves.
Smith and Allcock, Manchester—gas-fittings, &c.
Telephos Domestic and Street Lighting Company, Limited, London—distant gas lighting, &c.
Tintometer, Limited, Salisbury—Lovibond's tintometer.
Wilsons and Mathiesons, Limited, Leeds—gas stoves, &c.
Woodall-Duckham Vertical Retort and Oven Construction Company, Limited, London—smoke abatement appliances. [Duckham and Cloudsley, Gibbons Bros., Newton, Chambers, and Co., Thomas Vale and Sons.]
Wright, John, and Eagle Range, Limited, Aston, Birmingham—gas cookers, fires, gas-heaters, &c.

The firms exhibiting smoke abatement apparatus, furnaces, fuel economizers, stokers, &c., include the following: Bean's Bunsen Smokeless Furnace Company, Limited, London; Edward Bennis and Co., Limited, Bolton; Epoch Syndicate, Limited, London; Galloways, Limited, Manchester; James Gordon and Co., Limited, London; Hopkinson and Co., Huddersfield; Marine Mechanical Stoker Company, Limited, London; Meldrums, Timperley, near Manchester; Treibel Smoke Combustion Company, London; Triumph Stoker, Leeds; Victory Smoke Consumer and Fuel Economizer Company.

What is described in the catalogue as "The Gas House" is an exceedingly interesting feature to the visitors. Messrs. J. & J. Shaw, of Manchester, are responsible for the furnishing of four model rooms; Messrs. George Bray and Co., Limited, have carried out the lighting arrangements; and Messrs. Fletcher, Russell, and Co., Limited, have supplied the warming and cooking stoves. Here are to be seen in use the very latest appliances for lighting-up a house by gas, and the application of the patent switch for turning it on and off; while in the kitchen there are demonstrations of the utility, economy, and cleanliness of gas for cooking purposes. There is a counterpart to this on the opposite side of the hall, in "The Electric House," where are shown the latest applications of electricity for lighting, heating, and cooking.

As already indicated, gas-fires, stoves, radiators, and water-heaters loom largely at this exhibition; and they unquestionably form to the public an interesting section. With regard to the numerous models to be seen, there is nothing particularly new to be said about any of them; for quite recently, in the columns of the "JOURNAL," there have appeared descriptions of the latest production in these grades by the leading firms.

A good representative display is that of the Richmond Gas Stove and Meter Company, Limited. It may be remembered that they have been successful in securing the contract for all the gas-fires required by the Manchester Corporation for three years ending Sept. 30, 1914; and the agreement provides that the fires fixed by the Corporation on the simple hire or hire-purchase system shall be inspected not less than three times in one year, so that the fuel and burners may be kept in good condition. At their stand, the firm have on view the latest of their models in gas-fires, including the quite recent series "The Crusaders," the perfect combustion in which was evident even to the casual observer. Of course, the "A.B.C." patterns, which can be hired from the Manchester Corporation Gas Department from 4s. per annum, come in for a good deal of attention, and are a very popular series. There is also close by the "Egyptian," of the more powerful type, with heat-saving canopy and "duplex" tap and burner; and a wide range of samples specially recommended so as to harmonize with rooms decorated in the designs of various known periods—such as the "Renaissance," "Louis," and "Chippendale." There is likewise at this stand a display of the "Monarch" series of gas-steam radiators, with automatic control to save gas when the heat is fully generated; the "Daisy" greenhouse heater; and the "New Model" gas cooking-stove, claimed to be the most up-to-date of its kind.

At the stand of the Parkinson Stove Company, Limited, the visitor is faced with a choice variety of gas-fires, radiators, and cookers, including the "Cretan." The cheaper makes in this line are also shown, and so with the other "popular priced" gas-fires supplied by the Company. The public consequently have plenty to select from. Here are shown in operation the Maughan geysers, embracing all recent improvements for safety and efficiency, and working automatically with spray for cold, tepid, or hot water as required in the bath. One noticeable feature about this stand, in addition to the exhibits, is the excellent lighting arrangements; the lamps being of the Company's own manufacture, and ranging from 150 to 700 candle power. Another point to be remembered in connection with the Company's exhibits is their "Holborn" circulator—a compact and substantial gas apparatus which is attached to the ordinary circulation pipes, enabling the same service of hot-water throughout the house to be obtained without lighting the kitchen fire.

The Davis Gas Stove Company, Limited, make a special feature of gas-fires, stoves, and radiators. Their new "barless" gas-fires are obtainable in no less than 95 patterns and styles of finish, the chief of which are on view. Visitors are shown how the system of interchangeable fronts makes it possible, at practically a moment's notice, to adapt one of the new "barless" heaters so as to harmonize with its surroundings. Special accessories are a marked feature of these fires; and it is demonstrated how the side boiling-burner, the brass-wire dress-guard, and the special adjustable trivet may be used. There is also exhibited the latest of the firm's new "barless" fires, known as the "Inset," which, as its name implies, is made for the purpose of letting into any ordinary fire-grate without unsightly projections or overlapping of any sort. The other exhibits at this stand include the "Steamless Radiator," used chiefly for public buildings, halls, landings, and staircases, and the "Luminous Steamless Radiator," made on the same principle; likewise the "Gilled" circulating boiler, gas-heated, for supplying hot water throughout the house; and the gas-heated greenhouse heater.

The principal feature at the stand of Messrs. R. & A. Main, Limited, is the firm's "D.S.O." series of gas-fires, embodying all the latest points in gas-fire construction. Two prominent novelties are the "Santa Claus" and "Adaptable" fires, both made with special canopies, so that they can be neatly applied to modern interiors. The "Adaptable" has been designed so as not to be a separate unit, but to fit into, and form a part of, any modern coal-grate interior. It has been standardized with the "D.S.O."—the integral parts, such as the burner, fuel, fuel-supports, &c., being interchangeable. The firm also show their last model of the "St. Nicholas" fire, which was first introduced in 1909. Two years' experience of its working have enabled Messrs. Main to effect some improvements and refinements which are now embodied in the "Mark II. St. Nicholas." The fire has been designed to adapt itself to any modern grate interior, and is made in five standard sizes. Messrs. Main have on view, in addition to the gas-fires, their well-known types of cookers, gas-grillers, iron-heaters, wash-house boilers, and water-circulator.

Messrs. John Wright and Co. show a fine range of gas-fires of the "Thermo X" type in various designs and sizes; perfect radiant heat with a minimum consumption of gas being claimed for them. Of the firm's popular "Eureka" gas-cookers, of which more than a million have been sold in the United Kingdom, they have on show the latest design. There is also the "Sun" gas-heated high-pressure boiler, fitted with patent thermostat, which automatically controls the gas supply, so that water is kept at a fixed degree of heat with quite a small quantity of gas; the "Garajo" low-pressure boiler, for heating greenhouses, &c.; and the hot-air generator for drying-chambers.

At the stand of the Telephos Domestic and Street Lighting Company the visitor is given particulars of the Telephos gas-switch for lighting and extinguishing gas-burners from any distance by means of a push-button, without a constant bye-pass; also the Broadberry automatic controller for street-lamps.

The features of the other stands may be briefly indicated as follows: The Ramie Company, Limited, have a working exhibit showing the "Ziemar" incandescent mantle in process of manufacture. Clark's Syphon Stove Company, Limited, exhibit, among other of their productions, the "Elbard" patent gas toasters and flat-iron heaters. The "Ovee" Light Company show their specialities for high-pressure gas lamps, heaters, and radiators. The Carron Company have dining and drawing rooms fitted with new pattern gas-fires, also cookers, geysers, and radiators. The Rotary Meter Company have on view quite a new thing in meters, which shows in money the value of gas consumed by gas-fires, &c. It solves the vexed question of what to charge a guest for firing, and is said to be "a boon to boarding-house keepers and hotel proprietors and managers." Messrs. Duckham and Cloudsley, Limited, constructors of the Woodall-Duckham vertical retorts, exhibit a complete set of coke-extractor gear and retort-seating castings and a full-size section of a standard vertical gas-retort. Messrs. George Bray and Co. have a wondrous variety of burners for household and general lighting, incandescent burners, &c. The Cannon Iron Foundries, Limited, show their "Iris" fire and the "Oto" gas-fires, as well as the other models so familiar with their name; also gas-heated radiators, cookers, and meters. Messrs. Arden Hill and Co. make a full exhibit of their "Acme" gas fires and cookers, the "Mars" gas-heated radiator, the "Janus" gas-oven, the "Alpha" and "Beta" gas portable washing coppers, and the "Zenith" automatic high-pressure boiler. Messrs. Wilsons and Mathiesons, Limited, have on view their "Circulator" water-heater, "Premier" gas-cooker, and "Savoy" and "Wilson" gas-fires, as well as the "Canyon" geyser.

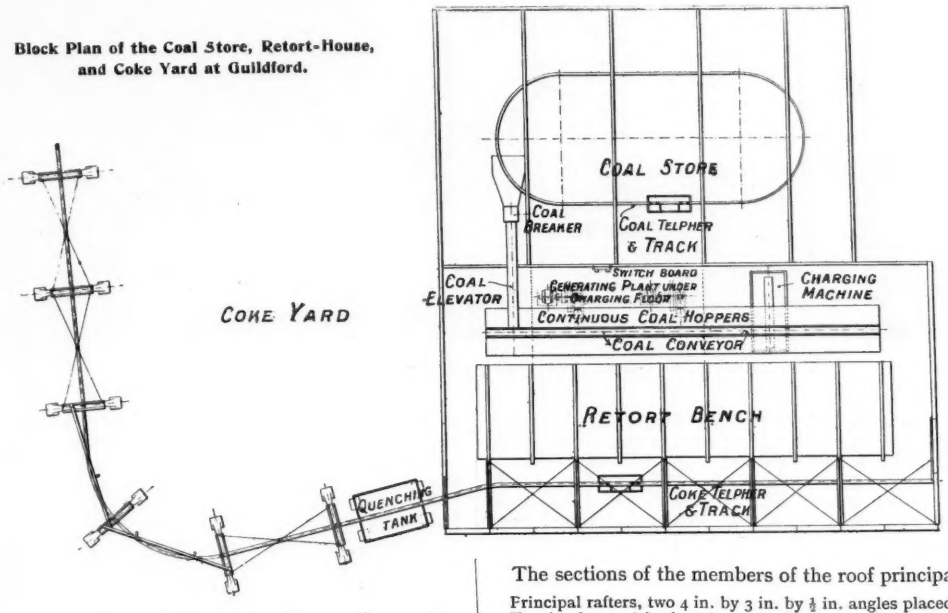
NEW CARBONIZING PLANT AT GUILDFORD.

By P. C. Cleasby.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Thursday, Nov. 9.]

Although the coal-store and the electric telpher and grab are only in course of construction, I propose to describe the complete carbonizing plant as it will be when finished. A block plan showing the general arrangement of the coal-store, retort-house, and coke yard is attached.

Block Plan of the Coal Store, Retort-House, and Coke Yard at Guildford.



Retort-House.

Building.—The retort-house is a steel-frame building reinforced with brickwork; and the steel roof is covered by slates secured to the angle steel purlins by means of lead nails. The steel framework of the house, the bench framing, floor joists, and hopper joists are all tied together, forming a complete structure. The measurements of the house are 106 ft. long by 56 ft. 6 in. wide by 41 ft. 6 in. high to the eaves. The following table shows the section of the principal stanchions, bracing, and girders of the house and retort-bench.

Position of Member.	No.	Section.	Size.	Weight per Foot.
Corner stanchions of retort-house	4	Two channels placed back to back	12 in. × 3½ in.	32·88 lbs.
Side stanchions of retort-house	20	Joist	12 in. × 6 in.	54 ,,
End stanchions of retort-house	8	,,	8 in. × 6 in.	35 ,,
Bracing between stanchions on charging side of retort-house	4 rows	,,	6 in. × 3 in.	12 ,,
Diagonal bracing in alternate bays		Angles	3 in. × 3 in. × ⅜ in.	
Bracing in end facing coke yard	1 row	Joist	8 in. × 6 in.	35 ,,
	4 rows	,,	6 in. × 3 in.	12 ,,
Bracing in end adjoining c.w. gas plant	1 row	,,	8 in. × 6 in.	35 ,,
	3 rows	,,	6 in. × 3 in.	12 ,,
Girders carrying coal-hoppers	10	,,	18 in. × 7 in.	75 ,,
Floor girders, charging side	10	,,	12 in. × 6 in.	54 ,,
Floor girders, discharging side	10	,,	12 in. × 6 in.	44 ,,
Floor girders, ends of bench	8	,,	8 in. × 6 in.	35 ,,
Girders for carrying rail upon which the machine runs	2	,,	12 in. × 6 in.	54 ,,
Rails	2	Rail	6 in. × 2⅜ in.	18 ,,
Columns under floor joists on charging side of house	10	Joist	8 in. × 6 in.	35 ,,
Mouthpiece bracing, charging side	4 rows	Channel	6 in. × 3 in.	12 ,,
	1 row	Joist	6 in. × 3 in.	16 ,,
Mouthpiece bracing, discharging side	4 rows	,,	5 in. × 4½ in.	18 ,,
	1 row	,,	6 in. × 3 in.	16 ,,
Bracing for main arches	2 rows	,,	5 in. × 4½ in.	18 ,,
Buckstaves on charging side	10	,,	16 in. × 6 in.	62 ,,
Buckstaves on discharging side	10	,,	12 in. × 6 in.	54 ,,
Buckstaves at ends of bench	8	,,	16 in. × 6 in.	62 ,,
Bracing between end buckstaves	2 rows	,,	5 in. × 4½ in.	18 ,,
Tie-rods	4	Round	2 in. diam.	

The sections of the members of the roof principals are:

Principal rafters, two 4 in. by 3 in. by ½ in. angles placed back to back.
Tension bars, 3½ in. by ⅜ in. and 3 in. by ⅜ in. flats.
Struts, 3½ in. by 3½ in. by ⅜ in. and 3 in. by 3 in. by ⅜ in. angles.
Tie-rods, 4½ in. by $\frac{5}{16}$ in. flats.
Purlins, 1¾ in. by 1¾ in. by $\frac{5}{16}$ in. angles.

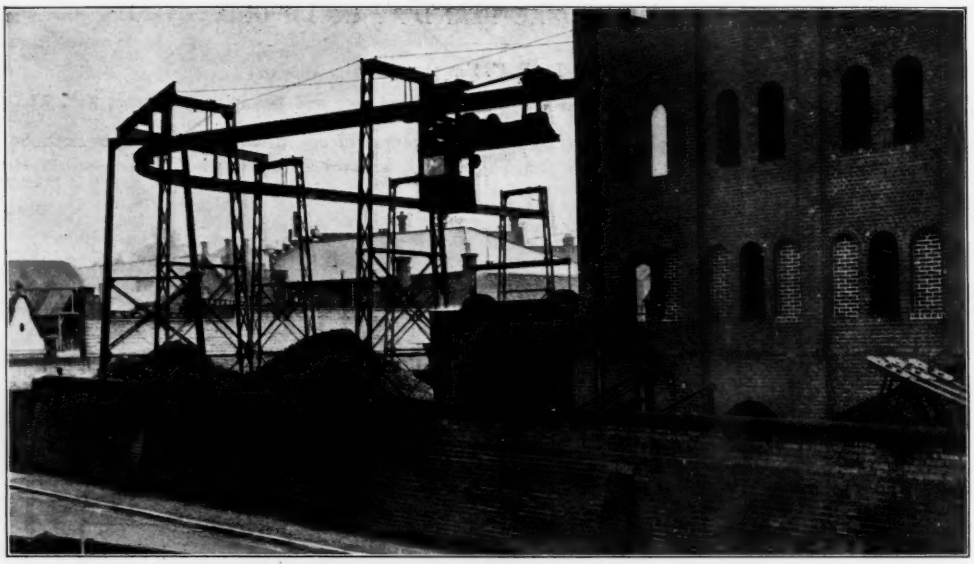
The floors are concreted over and strengthened by lock woven mesh reinforcement, which is cheap, efficient, and easy to use.

The thickness of the brickwork varies very considerably; the minimum being 9 inches. So far as its stability is concerned, 4½ inches minimum would have been sufficient; but for the sake of appearance, and other reasons also, it was decided to keep to the minimum of 9 inches.

Retort-Stack and Chimney—The retort-stack is 90 feet long by 20 ft., 2½ in. wide by 23 ft. 4½ in. high. The main-flue is 3 ft. 6½ in. wide by 3 ft. 6½ in. high with a 4½-inch division wall in the centre. The chimney is 4 feet square by 60 feet high. The main arches for the settings are 8 feet wide inside, with a semi-circular arch. This arch is formed of a 9-inch ring covered by a 4½-inch ring. The clear height inside the main arches is 21 feet. Each arch contains eight through retorts Ω-shape, with a section 23 inches by 16 inches.

Retorts.—The retorts are set in four rows, two in each row. This method of setting allows of very even heating, and is economical in ground space. In the bench I am describing the area covered is 1817 square feet; whereas if the same number of retorts were set in three rows 2000 square feet would be occupied. Another advantage of this arrangement is that it does away with the bull's-eye retort, which invariably gets hotter than any other. Of course, the drawback to the four tiers is the difficulty of charging the high tops in case of breakdown. But this should be so rare that it is hardly worth taking into consideration, and even then, temporary platforms could be rigged up for the purpose. The settings are built upon the Klönne system, with one furnace to each bed on the discharge side. The mouthpieces are Drake's self-sealing type with an eccentric, giving the lids a circular movement when tightening-up for cleaning the tar off the face.

Ascension and Bridge Pipes, Hydraulic Main, &c.—The ascension pipes, on the charging side only, are 8 inches diameter. The bridge pipes have one cleaning door at the top, fixed by means of two eye-bolts. The end of the dip pipe which touches the liquor is bevelled. The hydraulic main is in one continuous length, with division plates to each bed; the division plates being continued so as to form the supports from the cross joists. The section of the hydraulic main and the arrangement of the connections are very similar to those described by Mr. Ferguson Bell, of Derby, in his paper before the Institution of Gas Engineers in 1909. The tar outlets are 4 inches diameter; and they connect into two 6-inch diameter tar-mains running to the tar-towers at each end of the bench. The 6-inch diameter tar-main has a fall of 1 in 28. The centre section of hydraulic main has two tar connections, so that this section can be turned at will into either of the two tar-towers. The reason for this is that if five beds were working the whole of the tar would go into one tar tower; but if six beds were at work, four would go into the one and two into the other, as I was afraid if the contents of only one hydraulic had to run into one tower over three cold beds there might be difficulty with stoppages.



The Telpher Plant at the Guildford Gas-Works.

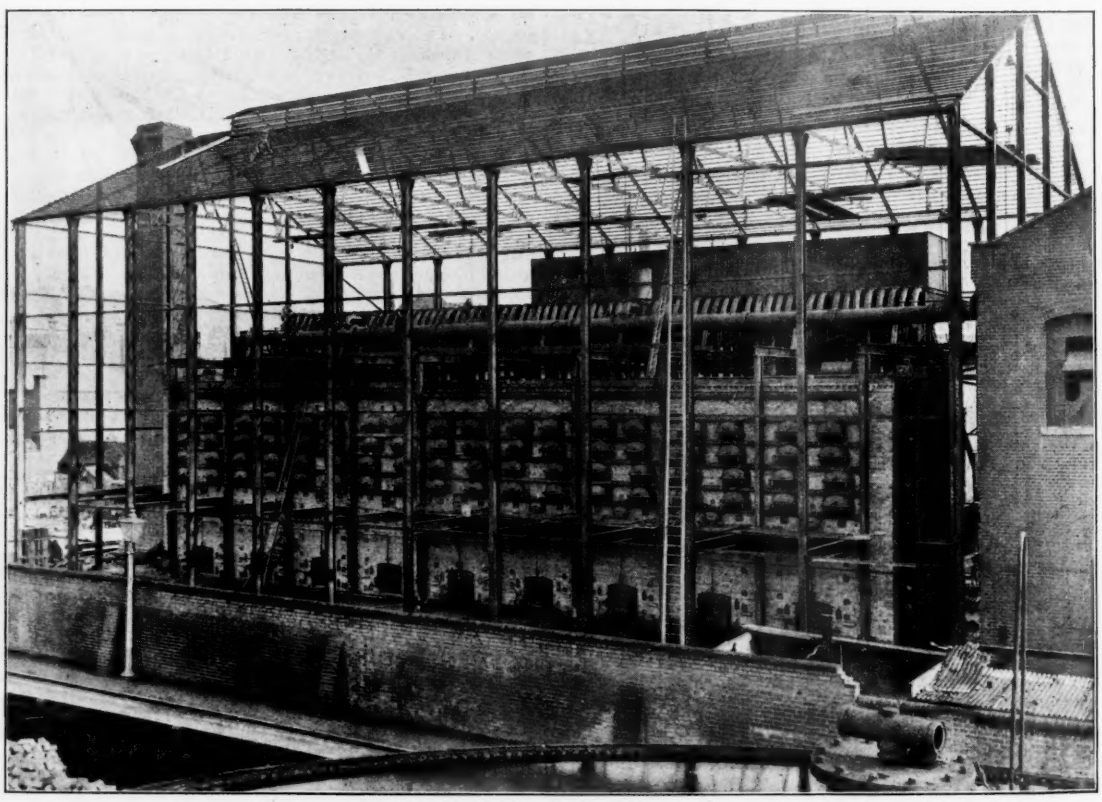
Over each tar outlet is fixed a 4-inch diameter pipe, having a 3-inch seal and provided with a cap, so that, in case of any thick tar in the outlet, it can easily be cleared. The gas outlets to each section of hydraulic are 8 inches diameter, and run into an 18-inch collecting main, from which, by means of two 10-inch connections and valves, the gas proceeds to the 18-inch foul-main. An 18-inch valve in the centre of the collecting main makes it possible to clear out half of this main while the other half is at work. Two retort-house governors—a 10-inch and an 8-inch respectively—are provided. The foul main proceeds from the retort-bench, round the house, to the condensers. The tar towers are 28 feet high, rectangular, 3 ft. by 1 ft. 3 in. The sides are formed by 15 in. by 4 in. channels, and the front and back are ¼-inch plate stiffened with 6 in. by 3 in. by ⅜ in. tee-steels.

Stoking Machinery.—The retorts are charged by means of a Fiddes-Aldridge simultaneous discharging and charging machine, which takes its coal from a continuous coal-hopper running the length of the house, and holding coal for about 30 hours supply. Up to the present, however, I have been able to manage without working the coal plant between Saturday mid-day and Monday morning. The method of working has been that during the day on Sunday the men go back under the hoppers above the retorts which are not working, and, by taking their supply from these, leave sufficient coal for the night men. The hoppers are fitted with Aldridge and Gibson's automatic hopper doors—one over each vertical row of retorts. The machine, as it passes along the house, opens the door in the hopper, takes the charge of coal into the measuring chamber, and, as it passes still further along, closes the door again before coming into position in front of the retort.

Coal-Store.

The coal-store, like the retort-house, is a steel frame structure reinforced with brickwork; and one wall is common to both the retort-house and the coal-store.

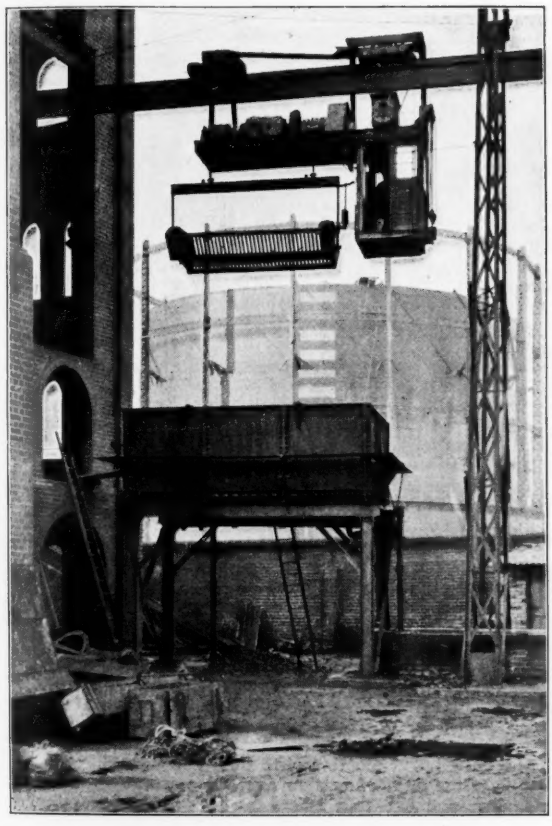
Building.—The building is 90 feet long by 54 feet wide by 41 ft. 6 in. high to the eaves. It has four cross girders, each formed of two 12 in. by 3½ in. channels placed back to back ⅜ inch apart. These girders are supported in the centre by four lattice-work columns. The bottom flange of the cross girders is 40 ft. 6 in. from the floor level. Suspended from the cross girders, which are provided with central struts for additional support, is the electric telpher track, which is built up of a 15 in. by 5 in. joist,



The New Retort-Bench at Guildford.

stiffened laterally by a 7 in. by 3 in. channel mounted on top; and on the top of this is the track rail secured with hook bolts through the web of the channel to the track joist, so that it can be easily removed when worn. This track is slung from the cross joists by means of L shaped built-up steel hangers, and is fixed parallel to the sides of the house; each portion being 14 feet from a wall and connected together with semicircular ends. This arrangement allows of coal being stored to a height of 25 feet, and will allow for the storage of 2000 tons.

Electric Telpher.—This is of the mono-rail type, which has obviously many advantages over the one which runs on the bottom flange of the track joist. It is almost identical with the coke telpher described later in the paper. The telpher is equipped with a Hone's patent automatic grab, with a capacity of 15 cwt. of coal, or probably about 20 tons per hour in ordinary working. For this figure all the remaining coal plant is designed. The grab picks up the coal and discharges it into a smaller hopper over the breaker, through which it passes to the boot of a bucket elevator, and thence is carried up to the push-plate conveyor, which runs along the top of the continuous hopper. The breaker and elevator are chain-driven from one motor; while the conveyor has a separate motor, with reducing gear.



The Coke-Skip and Coke-Quenching Tank at Guildford.

Coke Plant.

Electric Telpherage Installation.—The coke-handling plant is an electric telpherage installation, and consists of a mono-rail track running through the house at a distance of 5 ft. 6 in. from the face of the bench. It passes through an opening in the gable end of the retort-house, over the storage ground. The total length of the track is about 220 feet; the height above the stage floor being 22 feet and above the yard level 32 feet. The track is supported outside (at 25 feet spans) by means of trestles of lattice-work construction, and inside the house by extensions to the existing buck-staves and cross-joists carried across to the retort-house structure. A cast-iron quenching tank is mounted on a steel structure just outside the house, and below is a brick pit, filled with clinker, to filter the excess of water before it goes away to the drains.

The electric telpher itself is of the latest type, on the balanced bogey design, and is, as near as possible, a duplicate of the telpher in the coal-store, the two points of difference being: (1) That the coke telpher is arranged with two hoisting drums on a single shaft for carrying the two wire ropes from the skip, whereas the coal telpher is arranged with a single drum for coiling on the chain operating the coal grab; and (2) the wheel-base of the coal telpher is made considerably less than the coke telpher, as the machine has to travel round a very much smaller curve. Both of the machines have separate motors for hoisting and for travelling, with efficient hand and foot brake gears for both travelling and hoisting. Both machines are made so that as many parts as possible are interchangeable; and the four motors are of an exactly similar type. The machines are of the swivel bogey type, for running on curved tracks of small radius.

Each machine is fitted with an operator's cabin, with glazed windows, sliding doors, &c. The whole of the control of the telphers is performed by the driver inside the cabin, including the tipping of the skip or opening and closing the coal grab at any desired height. The coke skips are arranged to hold 17 or 18 cwt. of coke—two retorts being discharged into each skip. The skips are lowered on to the stage floor and the coke discharged into them. They are then hoisted and conveyed out of the house to the quenching tank, where they are partly submerged and lifted out again immediately, the coke is thus quenched without being saturated. The coke is then discharged on to the heap wherever required; the skip being lowered on to the heap before it is tipped, so as to avoid, as far as possible, any breakage of the coke. The coal telpher is arranged with positive and negative bare trolley wires, owing to the large accumulation of coal dust in the store; but in the case of the coke telpher, a single positive trolley wire was provided, with an earth return through the telpher track rail.

Generating Plant.

The generating plant is in an engine-room, built under the charging floor of the retort-house, and consists of two 35 H.P. gas-engines driving by means of direct flexible couplings two E.C.C. dynamos, which generate current at 225 volts. The size of the different motors is as follows:

Coal breaker and elevators		16 H.P.
Coal conveyor		5 ,,
Charging-machine		16 ,,
Four motors on the coal and coke telphers	each	11 ,,

Cost.

The cost of the installation was as follows:

(1) Retort-house and chimney, complete with all settings, bench bracing, bench ironwork, floors, steel framework, roof, brickwork, and slating	£6,600
(2) Fiddes-Aldridge stoking machine, generating plant (in duplicate), coal breaker, coal elevator and conveyor, continuous coal hopper, &c., &c.	4,328
(3) Extras	300
Total	£11,228

The above figures do not include foundations, coal store, coal telpher and track, or coke telpher and track; but with these exceptions they include everything described. The cost shown works out at just under £78 per mouthpiece.

The cost of the coke plant was approximately £1000; but I am unable as yet to give the cost of the coal store and coal telpher.

Power Required.

I have prepared two charts—the one showing the power required for the various operations of the charging-machine and

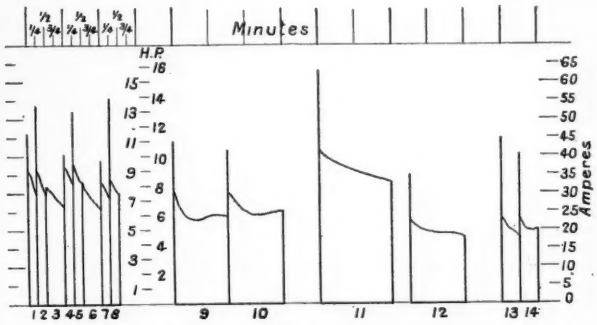


Diagram showing the Power Required for the Various Operations of the Fiddes-Aldridge Charging Machine.

Chart No. 1.—*Charging-Machine.*

Item No.	Work Performed.	Average Power Required.		Time Occupied.
		Amperes.	Horse Power.	
1	Pushing coke out of, and taking coal into, retort	33	8¼	¼ mins.
2	Withdrawing chain	33	8¼	¼ ,,
3	Travelling from one retort to corresponding retort in the next bed	29	7¼	½ ,,
4	As No. 1	35	8¾	¼ ,,
5	As No. 2	35	8¾	¼ ,,
6	As No. 3	29	7¼	½ ,,
7	As No. 1	31	7¾	¼ ,,
8	As No. 2	32	8	¼ ,,
9	Travelling from end to end of retort-house	24	6	1½ ,,
10	Ditto	24	6	1½ ,,
11	Lifting from bottom tier to top tier	36	9	2 ,,
12	Lowering from top tier to bottom tier	19	4¾	1½ ,,
13	Running empty chain into empty retort	20	5	½ ,,
14	Withdrawing empty chain from empty retort	20	5	½ ,,

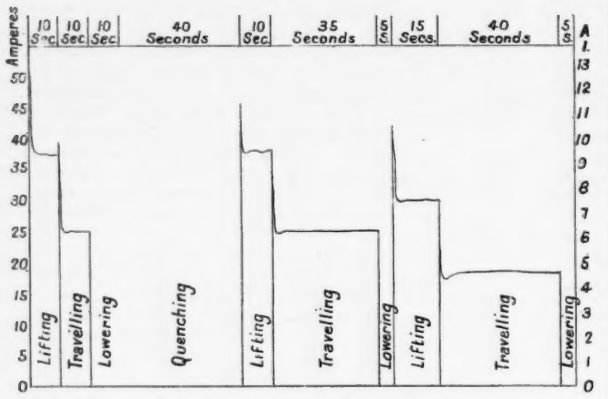


Diagram showing the Power Required for the Various Operations of the Coke Plant.

CHART NO. 2.—*Coke Plant.*

Item No.	Work Performed.	Average Power Required.		Time Occupied.
		Amperes.	Horse Power.	
1	Raising skip containing about 17 cwt. of hot coke from stage floor level .	37	9¼	10 secs.
2	Travelling from retort to quenching tank	25	6½	10 ,,
3	Lowering into quenching tank . . .	*nil*	*nil*	10 ,,
4	Quenching	*nil*	*nil*	40 ,,
5	Lifting out of quenching tank . . .	38	9½	10 ,,
6	Travelling from quenching tank to coke heap	25	6½	35 ,,
7	Lowering on to coke heap	*nil*	*nil*	5 ,,
8	Tipping skip and lifting from coke heap	30	7½	15 ,,
9	Travelling with empty skip into retort-house	17	4¾	40 ,,
10	Lowering to stage floor	*nil*	*nil*	5 ,,
	Coal Plant.			
1	Elevator and breaker running empty	26	6½	
2	Conveyor running empty	8	2	
3	Elevator, breaker, and conveyor running full	46	11½	

the other doing the same for the coke plant. It will be noticed that at the beginning of each operation the power line rises considerably above the normal. This is no doubt partly due to the extra power required to overcome the inertia of the machine; but I believe it is principally the swing of the pointer of the ammeter. The following table shows the results in figures, with the addition of the figures relating to the coal plant.

The current used per ton of coal handled is about 1¼ units. This includes breaking, elevating, conveying, charging, and coke handling. The cost per unit for gas used is just under ¾d. The cost of running per ton of coal is slightly under 1d.

LABOUR CHARGES.

With regard to the labour charges, I will give as near as possible the labour required for working the whole house per day of twenty-four hours.

Two retort-house foremen, whose duties consist of the following: Opening and shutting doors on the charging side, looking after exhausters and reading station meter, emptying tar towers daily, firing small boiler which supplies steam for exhausters.
Two machine drivers, who also look after the gas-engines, dynamos, and engine-room.
Four men on discharging side, one of whom drives the coke telpher at night. These men clean the fires. Each furnace is clinkered once in three days.
One man during the day who will drive the two telphers and also keep the electric plant and telphers clean and in good order.

The total wages of these men per twenty-four hours comes to £2 12s. 4d.; and when the house is working to its full capacity, with 12 cwt. charges burnt off in twelve hours, the cost per ton of coal carbonized, from the time the coal is tipped from cart into store to coke on heap, and including the other work the retort-house foremen do, will be 7¼d. per ton. However, at Guildford we shall not be able to work all the house in the summer; so perhaps the fairest way is to take the annual amount of coal carbonized—presuming the house is worked to its full capacity in winter. Upon this basis, the cost per ton for labour will be 10½d. over a period of a year.

GENERAL REMARKS.

The reason why I have given no figures showing the cost of the foundations is because the circumstances vary so much in different places that, for purposes of comparison, they are useless. The subsoil at Guildford is far from being ideal from the point of view of foundations; and in the end we decided to put in a solid bed of concrete, about 3 feet thick, over the whole of the area to be covered.

The old retort-house upon the site of which we erected the new one was working on Feb. 1, 1910, and on Oct. 18 in the same year we were making gas in the new house.

With regard to the question of one ascension pipe, I should like to mention that the cost would have been increased by over £900 had ascension pipes on both sides been put in.

One question which has been asked me a number of times is whether the chain of the Fiddes-Aldridge machine cuts into the bottom of the retort. My experience goes to show that it does not, as, even when the retorts require scurfing, I have never seen a mark even on the carbon. My belief is that as soon as the pusher comes in contact with the mass of coke the pressure causes the head of the chain to rise a little above the bed of the retort, so that the chain, when it gets into the retort, does not actually rub on the surface. The thing which causes the wearing strips on the chain to wear out is through passing over the apron plate.

I find that I get the best results when burning 12 cwt. off in twelve hours; but when short of gas, I work 10 cwt. off in eight hours. The maximum charge I have been able to get into a retort with one stroke of the machine is 14 cwt.

[Some illustrated particulars of the plant referred to in the foregoing paper were given in the "JOURNAL" for Oct. 25, 1910 (pp. 253-54), at the time of the inauguration of the new retort-house.]

Discussion.

The PRESIDENT (Mr. H. C. Head, of Winchester) said they all appreciated the very able manner in which Mr. Cleasby had given information as to his most interesting plant at Guildford. He had not only supplied them with a description of it, but he had given the initial cost and working costs; and he had brought his working drawings for examination. When he (the President) read the paper, the first thing he wanted to congratulate Mr. Cleasby on was that a Company of the size of the one at Guildford had gone in for complete machinery for both coal and coke handling. Mr. Cleasby was to be complimented on this; and he was sure the results fully justified his pluck. At the same time, there were other people to be congratulated—these were the Directors. The Directors of medium-sized companies were, as a rule, very loth to put their hands into their pockets for large sums, even though it had been made clear to them that they were going to earn money by doing so. He congratulated the Directors of the Guildford Company upon having made such an excellent investment as they had done. He had hoped that Mr. Bell, of Derby, would have been present to open the discussion; but he could not attend. But they had a communication from him, which he would ask the Hon. Secretary (Mr. W. E. Price) to read.

Mr. J. FERGUSON BELL (Derby) wrote: With respect to Mr. Cleasby's paper on his new carbonizing plant at Guildford (upon which plant he is to be congratulated), I notice he states that if ascension-pipes (including, of course, hydraulic mains, &c.) had been placed both sides of the retort-bench, they would have increased the cost of the installation by over £900, which, from an extended experience of working with ascension-pipes on only one side of the bench, would, I venture to think, have been money well spent. I find that with ascension-pipes on one side of the bench only, there are invariably some 20 grains of carbon disulphide per 100 cubic feet more in the crude gas than with retorts—working under exactly similar conditions in respect of weight of charge, kind of coal, and temperature of carbonization—having ascension-pipes on both sides; in each case, heavy ten to twelve hour charges being employed. Sulphur, in the form of carbon disulphide, is a noxious impurity in the gas, and one that is difficult to remove with certainty. Hence I think that the production of carbon disulphide should, as far as possible, be avoided. In a paper read by me before the Institution of Gas Engineers in 1909 (which Mr. Cleasby is good enough to refer to), I pointed out that ascension-pipes on one side of the bench only were employed; but further experience has convinced me that, as far as sulphur impurities are concerned, it is better to have pipes on both sides of the bench, and see that both pipes work. My theory is that the gas in passing along the space in the retort above the coal is subjected to a temperature of probably 800° C.; and as sulphuretted hydrogen starts to decompose at a temperature of 400° C., a portion of this gas is resolved into sulphur vapour and free hydrogen—the sulphur combining with some of the decomposed hydrocarbons into carbon disulphide. I referred to this in an exchange of views with Mr. Morrison, of Sheffield, who wrote to me as follows: "I have duly noted what you say, especially as regards carbon disulphide, which bears out what we find here. This summer we made a large quantity of gas with retorts fitted with one ascension-pipe, and certainly carbon disulphide has been higher than at either of the other two works where the retorts in use are fitted with two ascension-pipes." Perhaps some of the Southern members who have inclined retorts will state their experience in respect to sulphur impurities.

Mr. JAMES W. HELPS (Croydon) said he had the pleasure a few days ago of visiting Guildford to look at this installation; and he must say, the same as the President had done, that he heartily congratulated Mr. Cleasby upon the work he had accomplished, and upon the courage and power he had shown in persuading his Directors to put up such a splendid installation for such a small Company. With regard to the point raised in Mr. Bell's letter as to the single ascension-pipe, it was an important one. He (Mr. Helps) might say that at Croydon he had two entirely different

sections of carbonizing plant—complete gas-works really—working at the same time. In one section the ascension-pipes were on both sides of the retorts; and in the other section only on one side. They were 7-inch pipes. They could not put them on both sides in the one case, because, with their settings of tens in two rows, it was impossible. His experience was that the sulphur compounds were distinctly higher in the section where the single ascension-pipes were at work. His Assistant (Mr. Caddick) was only talking to him about it that morning; and he (Mr. Helps) had particularly asked Mr. Cleasby whether he had a similar experience. It also seemed to him (Mr. Helps) that, where retorts were fitted with single ascensions only, the coal was never so well burnt off on the side where there was no ascension as on the side where there was an ascension. Mr. Cleasby had given them particulars of what he considered would be the cost of working this installation in dealing with the coal from the time it came in to the time when it reached the coke heap. His figures were a little bit premature, because he was dealing with hypothesis rather than with real facts, seeing that the coal-store was not finished yet, and he had had no opportunity of finding what would be the cost of handling the coal. But there was this to be said, that the man who looked after the telpher which dealt with the coke would have plenty of time to work the telpher that would have to deal with the coal, because, discharging and charging retorts only every three hours, there would be ample time between to handle the coal. It seemed to him, in watching the process of discharging and charging, and dealing with the coke, that the telpher was, of course, the factor in the process which actually defined the rate at which the stoking could be carried on. The author told them that from the time the skip was raised to the time it came back again, three minutes were occupied. Mr. Cleasby had given him a few facts based on his experience with five settings of the retorts. They dealt, he said, every three hours with ten of the retorts; and the men were occupied about half an hour. This gave practically about an average of six minutes as the time occupied in handling the coke from two retorts by means of the telpher. If they were going to occupy six minutes in dealing with two retorts, it seemed to him that this apparatus, for extensive houses, would occupy too much time to render it generally acceptable by large companies. Everything, of course, was regulated by the speed at which the telpher could be worked. One could not possibly find fault with it as an effective telpherage machine. There was another point which was raised in the last issue of the "JOURNAL," that was as to whether the dipping of the skip of coke into the water-tank was calculated to damage the coke to any great extent. When he was considering what sort of apparatus he should use in a new retort-house a few years ago, he visited a works where a telpher was in operation, but it was not then on such modern lines as this one. There the coke was dipped into a somewhat deep tank. The dipping sometimes caused explosions, and the coke spurted out over the yard; but by care this did not happen very frequently. There was no doubt that dipping coke suddenly into a large quantity of water must cause it to fly considerably, and break up afterwards into a great amount of breeze. Mr. Cleasby told him that by lowering the coke very slowly into a somewhat shallow tank, the water extinguished the lower part of it, and the steam that rose through the upper part of the mass had considerable power in extinguishing the upper portion. He thus succeeded in getting a splendid looking coke, which contained only about 5 to 5½ per cent. of breeze. If they could get coke that contained such a small quantity of breeze as this, they would be satisfied; and if all vertical retort makers could get such a small amount of breeze as this they would be happy. He (Mr. Helps) congratulated Mr. Cleasby upon the results given in his paper, and upon having the courage of his convictions to put down this installation.

Mr. W. E. PRICE (Hampton Wick) said he should be sorry if the paper passed without he took the opportunity of saying how much he appreciated the work Mr. Cleasby had done at Guildford. He had had the privilege of seeing his installation under construction, as well as in use since the period it was first put into action. Although he (Mr. Price) could not lay claim to having seen all the mechanical stokers in the country, yet he could say he had never seen any stoking apparatus that had run more smoothly than that which was working at Guildford. He thought Mr. Cleasby was to be congratulated on the design of the plant. He knew as a fact that he had given a large amount of time to all the details of the installation. Regarding the stoking machine, it was wonderful to see the easy, smooth way in which it operated. There was no high-speed action about it anywhere; and the wear and tear, he should think, must be small indeed. The discharging and charging at the same time was an advantage; it might, perhaps, be a disadvantage on some occasions, as when a retort was required to be emptied. But it was not a difficult matter to arrange to discharge a retort without charging it. He should like to hear from others their experience of the use of telphers in comparison with coke-conveyors. It was a very difficult matter to say which was the better of the two. Of course, a great deal depended upon the conditions found at each works. In some works a conveyor was an impossibility where there was no exit from the end of the house, unless a cross conveyor was used; and no one there would use a cross conveyor if he could help it. But with a telpher the ease with which the direction of travel could be arranged was very remarkable, and particularly in the way curves could be taken by the machine. He had not noticed the difficulty that had been mentioned as to the breaking-up of the coke by dipping when quenching. As a matter of fact, the coke he had seen that had been so treated was not unduly broken. A coke heap on which coke was being continually dumped must of necessity appear to contain an unusual amount of breeze, and when the coke was taken for sale the breeze was left exposed. With hand charging and discharging, when a heap of coke was made, it was done by forks, and the breeze, when the coke was taken away, was left on the ground, and was removed elsewhere; so that when they saw a heap that had been made by dumping, they were naturally struck with the amount of breeze in it. He was proposing to follow very much on the lines of Mr. Cleasby; and he was thankful to him for the opportunity he had afforded him for seeing what he had done at Guildford.

Mr. T. PRICE (Walton-on-Thames) had also visited the installation at Guildford; and he said the smoothness and precision with which the Fiddes-Aldridge machine worked was certainly impressive. There was, too, an entire absence of dust. The slowness with which the parts of the machine worked seemed to point to long life, and an absence of wear and tear. Hitherto papers on this subject had been descriptive of apparatus applied to large works. They were therefore much obliged to Mr. Cleasby for giving them a paper in which they had had described machinery applied to a medium-sized works; and, of course, this appealed to a large number of members more than some papers had done before. Now that it was realized that heavy charges yielded a large make, there was no doubt machinery would be applied to smaller works than had been the case before. Of course, as undertakings descended the scale in point of magnitude, the labour costs would be greater. Mr. Cleasby's labour costs appeared to be low; and he should be interested in hearing what his labour costs with hand stoking were, and also his make of gas under the old conditions.

Mr. F. W. CROSS (Lea Bridge) said he had no experience of the telpher coke-conveyer; and, in fact, he had never seen one. But he should like to know whether Mr. Cleasby had had any personal experience of being in the apparatus, and driving it. He believed it was driven in front, with the heat of the hot coke coming towards the driver. Then when the coke was quenched, what was the effect of the strain. He should like to ask whether Mr. Cleasby had had any personal experience of this, because it was rather interesting.

Mr. J. FISHER (Tottenham) remarked that, in their experience at Tottenham with the Fiddes-Aldridge machine, there was always a short piece of improperly carbonized coal—say, about 6 inches—at both ends of the retorts. Mr. Cleasby mentioned that he found the chain of the machine did not cut into the retorts. At Tottenham they found the retorts cut the chain. He had seen a good many pieces of carbon very much marked with the side of the chain; but he was quite astonished at the rate at which the hard steel wearing surface on the bottom of the first few lengths of the chain got destroyed. The working costs with the machine were very low, and fully bore out Mr. Cleasby's figures.

Mr. BERNARD F. BROWNE (London) said that, while he considered it would be a presumption to criticize without careful study such an obviously well thought out paper as that read by Mr. Cleasby, he would venture to suggest that there was an explanation of the instantaneous rush of current shown by the ammeter when the motors were switched in from rest other than that offered by the author—namely, that the peak of the current curve was principally the swing of the pointer of the ammeter. He himself considered that the curves exhibited, plotted from the ammeter readings, were in themselves a very fine illustration of the indispensableness of the starting rheostat supplied with all direct-current motors, which, as was well known, was merely a convenient method of temporarily introducing a resistance in series with the motor armature until such time as this should have gained such a speed as to induce a back electro-motive force sufficient to prevent an undue rush of current. To make the matter clearer, if it was remembered that, in order to get a reasonable efficiency in the loaded motor, it was necessary that the internal resistance to the passage of current in the conductors of the motor armature should be very small (in the case of the motors in question probably not exceeding half an ohm), then it was evident that, if the full voltage current were applied directly to the brushes of an armature at rest, the fact of there being no "back electro-motive force" as a brake to the passage of current, there would instantaneously be constituted a short-circuit, involving in this instance a possible short-circuit current of somewhere about 450 amperes, which would undoubtedly injure the armature, and possibly do very serious damage to the dynamo itself. Hence the necessity of the instantaneous use of the added resistance in series with the armature as supplied by the starting rheostat. But it was unpracticable and unnecessary to introduce a resistance of such magnitude as to limit this instantaneous rush of current (due to the cause mentioned) to that of the average current used by the motor under load—it was merely necessary to prevent the rush from reaching a dangerous limit. Hence the rush of current on switching in the motor actually occurred, and was not merely the swing of the ammeter. Its only limiting factor was the strength of the temporary resistance of the rheostat which opposed it, and would be the same whether the motor were loaded or light at the moment of switching-in. Further, with regard to the valuable tables prepared by the author of the paper from the observed ammeter readings, these were apt to be misleading, unless the term "average power required" were qualified by the

statement that the horse powers in the tables were the powers exerted by the motors on the respective loads. Even then, in his (Mr. Browne's) opinion, the powers were underestimated, since, by calculation from the amperes dissipated, it was evident that the author had assumed an 83 per cent. efficiency for his motors, which at half-load was treating the motors very generously. It would possibly have been a better guide had the power required been stated in terms of the prime mover, which, taking the case of the work done in item No. 1 in the first table, would amount to nearer 12-horse power than the 8-horse power given, required from the gas-engine driving the dynamo. He noticed that the author specified his prime movers as consisting of two 35-horse power gas-engines, one of which would doubtless be in the nature of a stand-by; and he (Mr. Browne) calculated from the figures given in the author's tables that, if all the motors to be installed were required to exert only their average power simultaneously, their joint demand on the prime mover would amount to no less than 55-horse power. It was well known that gas-engines could not be overloaded with impunity; and he would expect that once the coal grab were installed and working, a single unit of generating plant would prove insufficient for the possible average demand. He felt that some explanation from the author as to his proposed arrangements for intermittent working, in view of these conditions, would be of interest.

Mr. CLEASBY, in reply, said he was very grateful for the extremely kind remarks made by the various speakers. With regard to the questions, there were not many to answer. As to the point of the sulphur due to the use of only one ascension-pipe, he could not say much about this, because he did not test for sulphur. When he went to Guildford, they had only one ascension-pipe in the old house; and so he could not say whether or not there was any difference between single or double ascensions. However, he had not heard of any complaints as to sulphur in the gas. After Mr. Paterson's paper, he did not think that there would be any difficulty in dealing with an excess if nuisance arose. Mr. Helps had remarked as to the costs being rather premature. Perhaps they were. But he had the retort-house and the coke plant working, and there was plenty of time to spare for the man to work the coal plant, which would not have to be operated at night. As to the time occupied with the coke telpher; he told Mr. Helps that it took about half-an-hour each charge. Well this included a lot of things. It was not altogether occupied in discharging and charging the retorts and conveying the coke. It embraced getting the engines started, and getting the men together, cleaning pipes out, and so on. He was certain the telpher men could do it in three minutes on the average. He had not set out to do things rapidly at Guildford, because there was no necessity, and it was not worth while. With regard to the quality of the coke through quenching, so far as he could see he did not think the breeze would be much over 5 per cent. He could not say this definitely; but he did not think so. Of course, no method of quenching coke by water was ideal. However it was done, the coke would be broken up by water to a certain extent. As to the wear and tear on the machine, they had had it going for twelve months now. The only thing they had renewed was a wire rope. As to the wear and tear on the machine at Tottenham, that must be, he thought, due to old retorts. He had had his machine going twelve months, and the wearing strips were not worn yet. The labour costs at Guildford, with hand charges, were 2s. 6d. per ton, exclusive of coal and coke trimming.

Mr. FISHER: Of course, our machines are fully occupied.

Mr. CLEASBY remarked that Mr. Cross had asked a question as to whether he had worked the telpher himself. He had not; but he had a pupil who gloried in going up and driving the machine. If there was any flame or smoke about, he did not think he would care to do so. The cabin was enclosed, and the man did everything from inside; so that he was fully protected. Concerning Mr. Browne's remarks, it was a long time since he went scientifically into the question of electricity. The figures as to horse power he did not pretend were correct. The amperes were correct; and if they divided them by four (225 volts), they would not be far out in arriving at the horse-power required. The gas-engine was 35 H.P.; and he could just drive the machine when charging the coke plant and the present coal plant, not including the coal telpher. He daresay the machines were overloaded at the time; but the electric motors would take a good deal of overloading. With regard to the size of the works that justified machine driving, he had changed his mind on this point. He had thought that Guildford was the rock-bottom size. He believed now, however, that, in a much smaller works, machine working would be profitable.

Water Purification by Ozone.—This subject has lately been dealt with in an article in the Engineering Supplement to "The Times." At the works supplying the Penkowja district of St. Petersburg, where the consumption amounts to 11 million gallons a day, the water is first treated with aluminium sulphate, then it goes through 38 sand filters at the rate of 1000 gallons per square metre of filtering surface per hour, and next passes to five sterilization towers for treatment with ozonized air. Of these, there are 128 of the Siemens and Halske type. The passage of the air through them and the sterilization towers is effected by means of water injectors worked by the water under treatment, using a head of about 13 feet. The plant is electrically driven by two 150 H.P. steam-engines, and the total costs of operation are stated to be from 0·86d. to 0·97d. per 1000 gallons.

A NEW METHOD OF EXAMINING COAL.

Dr. H. Strache, of Vienna, read a paper, on the "Gasification of Coal, and a New Method of Investigating it," before the Applied Chemistry Section of the German Natural Philosophers and Physicists, which was held at Carlsruhe last September. The following is a summary of the paper.

It is generally known that the distillation tests of coal in small scale laboratory plant show a lower yield of gas than is obtained from such coal in working on the large scale. The reason lies in the fact that on the small scale the coal is heated uniformly in comparatively small quantities, and hence the tarry vapours are able to escape without undergoing decomposition to the same extent as on the large scale. As a result, the small scale tests always display a low make of gas and a big yield of tar. In order to deal with this aspect of the problem of gasification on a small scale, the author tried the extreme case in which gasification was initiated at a low temperature, which was gradually raised, with constant removal of the products of distillation, until finally the residual coke was highly heated in order to complete the carbonization. This was carried out by heating from 0·1 to 0·2 gramme of coal in a small tube of refractory glass, and collecting the gas obtained therefrom. The quantities of gas so collected were, however, very small, and it was necessary to have a simple means of determining their calorific power in order to follow the course of the carbonization of the coal. Such a means was afforded by the author's explosion calorimeter [see "JOURNAL," Vol. CXI., p. 387], in which the gas under examination is exploded in a pipette, which is enclosed centrally in an air-tight glass jacket, the air in which becomes heated by the heat of combustion of the gas exploded in the pipette. The resultant effect is measured on a manometer, and the instrument having been calibrated by the explosion in the pipette of pure hydrogen, direct readings of the calorific power of the gas are obtainable. This calorimeter is applicable to the determination of the calorific power of any kind of combustible gas. In the case of poor gases—such as blast-furnace gas—a known proportion of hydrogen may be added to assist combustion.

The coal to be tested is finely powdered, and from 0·1 to 0·2 gramme is weighed out in a tube (bent at right angles) of resistance glass. A previously-ignited plug of twisted asbestos paper is inserted in the fore-part of the tube, which is turned downwards. The tube is connected by rubber-tubing with the explosion pipette; and for exact results the contained air is displaced by nitrogen, the end of the tube being drawn out to a point. The coal in the tube is then gasified by heating; the flame being made to play on the whole horizontal portion of the tube, so as to prevent condensation of tar vapours anywhere except on the asbestos plug. The gas passes into the explosion pipette. The heating of the tube is pushed ultimately to the softening point of the glass in order to complete the carbonization. The tip of the tube is then broken, and after the coke has cooled air is drawn through into the explosion pipette. The calorific power of the gas is then determined in the latter. The whole operation so far need only occupy ten minutes. The weighings are of: (1) The empty glass tube; (2) the tube with the 0·1 to 0·2 gramme of coal; (3) the tube with the coal and the asbestos plug inserted; (4) the tube with the asbestos plug after carbonization of the coal; (5) the tube after withdrawal of the asbestos plug; (6) the asbestos plug after drying in a desiccator; (7) the tube with residual ash after combustion of the carbon and hydrogen in the residual coke by means of a current of oxygen.

The products of the latter combustion are received in weighed absorption tubes charged with calcium chloride and soda lime, and from the amounts of water and carbonic acid absorbed therein the proportions of hydrogen and carbon in the residual coke are calculated. The carbonic acid produced in the explosion pipette by the combustion of the gas may also be determined, and the total amount of carbon in the gas thereby ascertained. The difference between weighings (3) and (4) gives the weight of gas driven off from the coal. The difference between weighings (1) and (5) gives the amount of coke produced, and its character is observed before combustion by oxygen. Weighing (6), less the weight of the asbestos plug, is the weight of tar produced from the coal. Omitting the comparatively unimportant determination of the carbon and hydrogen in the coke, the whole examination may be completed in less than an hour. The results obtained are said to be concordant, and to correspond with those of carbonization on a large scale.

The calorific power of the coal itself may be deduced from the results. Constam has shown that the calorific power of ash-free dry coke is practically constant whatever the description of coal from which it is obtained, while the tar may be assumed to have in all cases the same calorific power per unit weight. The calorific power of the gas is found in the calorimeter, and the sum of the calorific values of coke, tar, and gas gives the calorific power of the coal. Owing to decomposition of the tar being avoided in the examination, the calorific value of the gas is lower than on the large scale, while the yield of tar is greater. The results correspond with the production of semi-water gas in producers using bituminous coal. The figures obtained for the calorific power of the gas afford a good check on the gas obtainable from the particular coal. The author hopes to report later on tests in which the tar also is completely decomposed.

SULPHATE OF AMMONIA PRODUCTION AND SALE

Papers at the American Gas Institute Meeting.

As mentioned in the article by a correspondent, in last week's "JOURNAL," giving a general account of the proceedings at the recent annual meeting of the American Gas Institute, three papers were submitted on the manufacture and sale of sulphate of ammonia. The following are abstracts of two of them.

Mr. C. G. ATWATER read a paper on

PLANTS FOR MAKING SULPHATE OF AMMONIA.

The author explained at the outset that the object of his paper was to describe briefly the types of apparatus used in the manufacture of sulphate of ammonia, in so far as information concerning them was at hand. He then went on to say that this manufacture might be said to have begun on a moderately large scale in America in 1893, with the erection of bye-product coke-oven plants. Before this, sulphate was made at various coal-gas works and elsewhere; but the plants were necessarily of small capacity, as the supply of ammonia was limited to the works output. These conditions had, in great measure, been changed. A number of bye-product coke-oven plants had been built, many of which were successfully converting their ammonia into sulphate.

As in other lines of manufacture, one might expect to find the most economical production in the plants operating on a large scale. This was particularly true of a product like sulphate of ammonia, the making of which involved a certain amount of manual labour which might be cheapened or eliminated in large installations. It was partly for this reason that the present output of sulphate in America came almost entirely from bye-product ovens; these plants being by far the largest individual producers of ammonia, and therefore afforded the opportunity for making sulphate in large quantity. The usual recovery of sulphate from coal was about 1 per cent. of the weight of the bulk used; so that for the production of 5 tons of sulphate per day 500 tons of coal must be carbonized. There were but few coal-gas plants of this daily capacity in the United States; but, on the other hand, most of the bye-product oven plants exceeded it. In England, coal-gas works of such capacity were more frequent, and those of smaller size comparatively close together; so that opportunity had been afforded for the establishment of sulphate plants manufacturing on a large scale, in some cases drawing their supply of liquor from several sources. Both England and Germany, being larger producers of sulphate, had led America in the design of apparatus for the purpose; therefore much of his paper was taken from the practice of these countries. Germany, in particular, had developed the "direct" method of producing sulphate from coke-oven gas—a process which seemed likely to reduce the cost of plant and of operation.

Having described the original method of making sulphate of ammonia, and given an outline of the chemistry of the process, the author explained the nature of the plant required—viz., a still, pumps, and tanks for the crude liquor, apparatus for slaking, measuring, and injecting the lime, the necessary connecting-pipes, and a saturator. He then gave, by the aid of diagrams, descriptions of various plants—taking the simpler ones first. As these are all known to readers of the "JOURNAL," it will be sufficient to indicate their special features.

In the "Bamag" type of plant, the still is operated continuously and the saturators alternately; one being saturated while the other is having the sulphate dipped out and the acid bath prepared for another run. Its operation involves moving the sulphate by manual labour from the saturator to the draining-board, thence by wheelbarrow to the centrifugal dryer, and from this back to the storage-bin. An arrangement eliminating some of the manual labour in handling the sulphate has been devised by Messrs. C. & W. Walker; and an additional advantage is claimed for it in the increased durability of the lead lining of the saturator, which is of conical form at the bottom and thus facilitates discharge. The lining is consequently not bruised or abraded by the action of the dipping-ladles. The waste liquor from a still of this type should, it is stated, contain less than 0·006 per cent. of ammonia; and this with the consumption of 8 cwt. of good coal per ton of sulphate produced from crude liquor of 5·25° Twaddel. The plant erected by Mr. John H. Darby, of Brymbo, in connection with bye-product coke-oven plants goes a step farther in the direction of saving labour; the sulphate from several stills being conveyed mechanically from the saturators to the stores without any handling whatever. The plant illustrated in the paper is stated to be capable of dealing with from 250 to 270 tons of coke-oven liquor per 24 hours (equivalent to 10 to 16 tons of sulphate with liquor of 1·24 to 1·5 per cent. of ammonia), and is erected in three independent units, any one of which may be shut off without interfering with the others. Each unit consists of a still, a heater, and a saturator. In the Wilton plant, the salient point in the construction of the still is its accessibility for cleaning. The most interesting feature of the still, however, is the method adopted for removing the salt, which is done by a steam ejector or syphon. The bottom of the saturator is perfectly flat, except for a small well in the centre, in which the ejector stands. The ammonia vapour enters the saturator by two pipes, which come vertically through the top, and enter the centre of two crescent-shaped perforated pipes which surround the well. The perforations are arranged so that the vapour shoots downward and towards the well—blowing all the salt to the well, and at the same time thoroughly mixing and saturating the acid bath. The mother liquor comes in from the pot containing it, and falls to the bottom of the saturator just behind the perforated pipes. This type of plant has met with much success.

The processes described so far have been of the type generally used, in which water is the liquid by which ammonia is absorbed from the coal gas. Two have, however, appeared recently, in which this step has been eliminated, in part or entirely, and the absorption accomplished by the sulphuric acid itself. Both of these processes are of German origin, and are, respectively, that of Heinrich Koppers and that put forward by Dr. C. Otto and Co. The author said it was hardly fair to discuss these methods without some reference to the work of Brunk, who in 1903 obtained directly crystallized sulphate of ammonia by passing coke-oven gas through sulphuric acid, using two saturators in series. This attempt failed, because the gas contained tar, which contaminated the sulphate and complicated the operation in other ways. The success of the later attempts rests on ability to entirely remove the tar first. This is accomplished in the Koppers plant by reducing the temperature of the gas sufficiently to remove the tar by a Pelouze and Audouin scrubber; the gas being then reheated before going to the saturator. In the Otto plant, the tar is removed while the gas is still hot by the use of a jet of tar sprayed into the gas; the effect being to condense the tar mist into a liquid form which is easily drained off. Both methods are in regular operation at a number of plants, and both produce salt of an excellent quality. [The author described both systems in detail by the aid of diagrams.] The Koppers process is being introduced into America by Mr. Koppers, of Joliet (Ill.); and the Otto process by the United Coke and Gas Company, of New York. A modification of the Wilton plant has been brought out; its particular feature being that it adapts the Koppers arrangement to the purposes of a small or moderate gas plant. It has already been described in the "JOURNAL."

The author next came to the Burkheiser and Feld processes, which have also been fully described in our pages; and with these he brought his paper to a close. The Feld process is in operation at the works of the Central Union Gas Company, of New York.

Mr. W. N. M'ILRAVY read a paper on

THE PRODUCTION AND MARKET FOR SULPHATE OF AMMONIA.

The author, who has given particular attention to this subject,* began by pointing out that the United States now ranks third among the nations of the world producing, or rather recovering, ammonia from coal; and though the output is not as yet one-third that of England or Germany, its potential production is nearly as great as that of both of these countries together. He therefore thought a study of the present conditions was of value, as it must cast some light on the character of the development which it seemed extremely probable the near future would bring. About 74 per cent. of the estimated production of sulphate of ammonia in the United States last year came from bye-products coke-ovens; and the prospects were that any considerable increase in the production of the country would come from this source. He said the United States was not the only country in which the bye-product coke-oven played the principal part in ammonia production. In England, the greatest coal-gas country in the world, the proportion of sulphate produced in coal-gas works was but 47 per cent. of the total output; while the bye-product coke-oven yielded 26 per cent., and had more than doubled in the last five years.

Having considered the relation of the present to the possible extent of ammonia recovery, the author turned his attention to the probable direction of bye-product coke-oven development in America. Reasoning from what has been done, and considering the direction in which new construction is being planned, he came to the conclusion that the the centre of bye-product production, and therefore of sulphate recovery, would be in the vicinity of Chicago. Unfortunately this centre is not where market conditions are at present most favourable; and the recognition of this fact led the author to proceed to the consideration of the question of the disposal of the product. As its principal use is for agricultural purposes, the States in which the consumption of artificial fertilizers is largest are those in which the market for it is to be found. Unfortunately, these do not lie anywhere near the centre of production. Four of the States—Georgia, North and South Carolina, and Alabama—account for more than 3 million tons; and the adjacent States of Florida, Mississippi, and Louisiana consume nearly 500,000 tons more. But this is only 58 per cent. of the estimated consumption of the United States.

The conclusion arrived at by the author, after a thorough consideration of the subject from a geographical and a statistical standpoint, is that there is great need for comprehensive propaganda work in connection with sulphate of ammonia—indeed, this had, he said, been apparent for a long time to those closely in touch with existing conditions. He pointed out that such work is being energetically carried on in the agricultural countries of the world for nitrate of soda—the great competitor of sulphate of

* Mr. M'Ilravy, it may be remembered, attended the meeting of the Sulphate of Ammonia Committee held in London in the summer of last year, and gave some statistics in regard to coke-ovens in the United States, and the probable future production of sulphate therefrom.—ED. J.G.L.

ammonia; and he remarked that if such methods are necessary for articles like potash and nitrate, the output of which can be raised or lowered, within reasonable limits, with reference to the varying demand, it was much more needed for a product like sulphate, which is a bye-product, and is made entirely with reference to the demand for coke and gas, rather than to its own market prospects. He called attention to the fact that the Germans were the first to undertake this work for sulphate, and mentioned that an organization comprising a central office and twenty-two branch offices, in charge of trained agriculturists, is maintained in Germany. The results obtained in this way have led to the starting of similar work in France, Belgium, Holland, Denmark, England, and America. "England, the world's largest producer," said Mr. M'Ilravy, "was especially in need of such measures, since four-fifths of her output has to be placed on the export market instead of going on to her own farms, where much of it could be profitably used. Her propaganda has now been under way two years, and results are already apparent. In the United States propaganda has been carried on for a number of years past, on a gradually increasing scale." At first it was done only with the manufacturers, as the immediate consumers; but five years ago the necessity of work that would appeal to the ultimate consumer—the farmer—was apparent. As the conditions did not favour a direct appeal to him, the work was taken up with the State Agricultural Experiment Stations, of which there is at least one in each State and territory in the Union, and in some there are two or three—the total number being 63. In addition to this, there is an Agricultural College in each State. Working through the directors of the various stations east of the Mississippi, and also some of those west of it, as far as Colorado and Wyoming, by means of personal visits, lectures, and correspondence, the support of most of them has been secured. Many have included sulphate of ammonia in their scheme of experiments, and they are regularly supplied with sufficient for their purposes. Consequent upon this work, bulletins have been published giving the results of successful tests of sulphate of ammonia, and advocating its use. Where formerly no mention was made of it, it is now receiving its share of attention. The same line of approach has been followed with the separate agricultural colleges; and many of them have found a place for experiments with sulphate of ammonia as part of their farm demonstration work. The secondary agricultural schools have likewise been enlisted. This work is particularly important, as it affects the boys and young men who do not go to college, but return to the farm.

In closing his paper, the author emphasized the necessity for propaganda work being carried out with a high standard. He said the advice given as to the use of sulphate of ammonia should be such as would enlist the endorsement of recognized agricultural experts, for only in this way could a substantial and enduring reputation be built up. If his audience looked beyond the immediate commercial ends that such a propaganda must necessarily serve, they would see that it was really an active educational force on the one hand, and an aid in promoting the conservation of their natural resources on the other. It helped to transform a noxious waste into soil fertility and beneficent growth; and it was a movement of which the gas and coke industries had reason to be proud.

The text of the paper was illustrated by several maps; and in an appendix were given interesting statistics bearing upon the subject.

Mr. A. B. WAY had prepared for the meeting the following

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Society of British Gas Industries.—The autumn general meeting of the Society will be held at the Holborn Restaurant on the 23rd inst., under the presidency of Professor Arthur Smithells, F.R.S. We learn from the programme of arrangements issued by the Secretary (Mr. Arthur L. Griffith) that the general business meeting will take place at five o'clock; and at six a paper will be read by Mr. H. James Yates, the Chairman of the Council, on "Science and Co-operation in the Gas Industries," which will be followed by a discussion. At 7.30 p.m. the members will dine together.

AMERICAN COMMERCIAL GAS ASSOCIATION.

A Presidential Address and Some Papers.

The following points have been abstracted from the Presidential Address and some of the papers read at the Seventh Annual Convention of the American National Commercial Gas Association, which was held last month at Denver (Col.). The remaining papers will be noticed in succeeding issues.

PRESIDENTIAL ADDRESS

Of Mr. CLARE N. STANNARD, of Denver.

The Board of Directors have held meetings during the past year in Boston, Chicago, New York, and Denver. The meetings were enthusiastically attended, and a vast amount of work planned and executed. In our estimation, some of the most important things accomplished during the past year by the officers and Committees are as follows: The Accounting and Relations with Consumers Committee have performed splendid work through the columns in the Bulletin and Question-Box Department. We have an important duty to others than the commercial men; and the Committee have been meeting this duty by presenting and handling many subjects of vital interest. The Industrial Fuel Committee have compiled material which, when published, will be of inestimable value to the gas fraternity in the advancement of the sale of gas for industrial purposes. The Advertising Committee and the Board of Directors have spent much time over an advertising proposition. The plan contains much merit, and should have the hearty support of all the members. The Transportation Committee is the first one of its nature appointed in the history of the Association; and through it we have secured an immense amount of favourable publicity. The Committee were of great value in the formulating and distributing of transportation information. The Committee on Papers have worked long and earnestly, submitting an excellent list of authors and papers to the Board of Directors, who co-operated with the Committee in making the final selections. The subjects cover a wide and varied field; and the authors are all experts upon their respective subjects. The Membership Committee have laboured long and earnestly, and materially increased our membership. Company Sections have been formed in many parts of the country—more recently a number of large and enthusiastic ones on the Pacific Coast. We are convinced that the future rapid growth of the Association lies in the formation of Company Sections, and would recommend that next year special attention be given to the formation of State and Company Sections. From the experience of the past year, we would further recommend that someone possessing the proper qualifications should visit many of the larger gas companies, personally explaining to the management and employees the advantages accruing to both from the formation of Company and State Sections. At the Chicago Convention, December, 1909, President Frueauff recommended the publication of a bulletin. The suggestion was acted upon. The beginning was, as recommended, quite modest. The growth has been gradual, until at the present time the members have good reason to be proud of their official publication. The Board of Educational Control is a new departure, originating with the present administration. It is doing a most important work, and creating an influence which in the future will be clearly noticeable in the work of the commercial men. The success of the salesmanship course is assured—a large membership has been secured, and the work of the Board marks a new era in the history of the gas commercial world. The complete display and exhibition arranged by the Exhibition Committee and manufacturers provide many educational features and show continual progress in the illumination field and the application of gas both for domestic and industrial purposes.

OBJECTS OF THE ASSOCIATION.

Section 1 of Article 2 of the Constitution reads: "The objects of this Association shall be: First, the development of the use of gas and the promulgation of methods necessary for its sale. Second, to encourage the manufacturer to furnish suitable appliances for the use of gas for light, heat, and power. Second, the establishment and maintenance of a spirit of fraternity between the members of this Association." We are now truly national in our work. Besides having many members in all parts of the United States, we have a membership in Canada, Mexico, England, Japan, New Zealand, Hawaii, and other foreign countries. Thus we have an opportunity of making national strides in commercial advancement, making our Association a power in the gas manufacturing and gas selling world, advancing our own individual and collective interests, and better serving our consumers through an improved and more complete service, and, through increased sales, lessening the price of our commodity.

EDUCATION.

Education is the crying need of to-day—high school, college, technical experts, and then the application, which is the keyword of success. When the proper foundation has been laid, coupled with application, intelligent industry, and intelligent direction, we have the successful combination. Realizing that our Association should be of real, permanent benefit to its members, the Board of Educational Control, composed of recognized commercial experts and leaders of the world, supplies to one possessing a fair education the means of ultimately qualifying as a commercial expert. Members of our Association who are connected with the smaller companies have thus been given an opportunity of gaining knowledge heretofore impossible. Thus we believe this educational field of our endeavour is meeting a long-felt want.

BROADENING OF OUR FIELD.

Originally gas was used for simply the lighting of the residence or store, supplied at what now seems an excessive price; then the domestic field was exploited; later came the power and industrial applications; and now we have a combination of all the above—thus wonderfully increasing our field of usefulness. In a recent compilation, it was found that gas is being very successfully applied in 704 different ways. Our gas output has been wonderfully increased through the magnificent strides made by the manufacturers of both lighting and industrial appliances. We believe that the power and industrial fields offer the greatest opportunity for continued increased sales. Many papers have been written on how to develop the gas field. We will simply mention that the industrial manufacturer desiring to apply gas is often more interested in service and convenience than mere cost; and through efficient appliances supplied to us by the appliance manufacturer, we are enabled in many instances to secure this business, even though gas costs more than other fuels.

OWNERSHIP.

Public utility corporations may be owned and operated in many ways; but we will only mention the three in general practice at the present time. First, private ownership; second, municipal ownership; third, private ownership with municipal control of rates. Many instances might be cited which prove conclusively that private ownership is the most satisfactory of these three. Wherever a privately owned company, operating under a system of reasonable and proper rates, gives good service, and has due regard for the just treatment of the public, we are of the firm belief that there will never be a demand for a change in ownership. Recently some statistics were given which showed that the corporations are not owned by simply a few men of vast wealth using their power to oppress the people, but that, on the other hand, a great number of plain people were the owners of the corporations. The tendency is growing throughout the world towards co-operation, amalgamation, and consolidation; and we believe, from the facts and statistics presented, that where a corporation deal fairly with the public, there will be found no demand for municipal ownership or control.

THE ASSOCIATION'S FUTURE.

The Association's growth from the beginning has been steady and rapid. We now have the largest Gas Association in the world; our roll representing 3000 members. This number will still increase; and we shall, no doubt, in the near future double our present membership. On account of the present limitations of the Association's constitution and bye-laws, and the lack of funds, which even to-day hamper the progress of the Association, many things absolutely imperative and necessary to the good of the gas industry are being neglected.

Citing some of the most important instances, I would quote under "Suggested Work," taken from "Comments for Sub-Committee on Plan and Scope of the Public Policy Committee of the National Commercial Gas Association," the following: To take steps to see that all litigation of a general character which might produce precedents which would govern the entire business is followed up, and see that this litigation is properly defended or prosecuted as our interests may require. To demonstrate the fallacy of limited term franchises. To correct any antagonistic public feeling against gas companies, especially by educational methods where this antagonism is the result of popular error. To maintain the credit of gas securities with the investing public. To avoid the further adoption of the double standard of candle power and calorific value. To convince the public of the fallacy of special taxes on gas companies. To keep in touch with scientific or public movements which may have an effect on the gas business. To standardize the sizes of coke placed on the market, and secure the adoption of uniform names to designate each size of coke. To secure the offer of premiums or awards for applying gas, coke, or tar to new uses. To encourage the development of coke-consuming appliances. To secure standard methods for testing fuel-gas appliances. To encourage the development of appliances by securing suitable awards for novelty, excellence, and efficiency of fuel-gas appliances. To encourage research work.

Believing the time is now ripe for the Association to take on added responsibilities and duties, I recommend that we change our Constitution, sufficiently broadening its scope to permit the accomplishment of the work above suggested; and that we should further, at this time provide for the creating of company membership. The revenue to be derived from this new form of membership, together with our present source of income, would then place at our command sufficient funds to carry on the proposed new work of the Association. I would further recommend that a Committee be appointed to work out in full the necessary details for the fulfilment of the plans proposed, and that they report their recommendations to the next convention.

COMPARATIVE COSTS AND EFFICIENCY OF GAS AND ELECTRIC LIGHTING.

By W. M. BLINKS, of Kalamazoo.

The comparative costs of gas and electricity for lighting have been generally accepted as much in favour of gas. Electrical selling arguments, as a rule, conceded this, or, perhaps, more strictly speaking, ignored it, and have been built up on the points

of convenience, ornamental effect, distance control, cleanliness, &c. It is only recently that electric light has made its claim on the basis of direct lower cost to the user. At the last annual meeting of the National Electric Light Association, and again at the June meeting of the New York Section of the Illuminating Engineering Society, the claim was made that electric lighting is cheaper than gas lighting. In both instances, the electric figures were based on laboratory tests, and the gas figures on installation observation. Proof was not submitted at either time that electric working tests show the efficiency claimed; and the published records are all to the contrary.

The latest improved type of inverted gas arc lamp gives a mean spherical candle power of 24·1 per cubic foot of gas per hour, and a mean lower hemispherical candle power of 35·7 without any reflecting shade. Repeated tests in different places, under varying conditions, average 21 spherical candles or even better. Compared with the electrical showing of 1 horizontal candle power per 1¼ watts of the famed tungsten, I have been accustomed to regard this lighting business of ours as entirely able to look out for itself in the give-and-take combat of the twentieth century ways. It is not the part of wisdom, though, to underrate a competitor; and therefore, to ascertain if possible whether the strength of the opposition had really grown beyond my knowledge so much as to put our cause on the "back-number" list, a careful study was planned. This led directly to the columns of the Electrical Press, which naturally would reflect the thoughts and achievements of those in the forefront of that industrial army. It was very quickly noted that the commercial selling enthusiasm largely emanated from the front pages of these journals. Back, however, on the technical pages, where the results of research work and scientific investigations are published, we find a refreshing resemblance to those friendly parallel columns of earlier days when electricity did not deign to qualify beneath the ranks of a luxury.

After reproducing some comparative costs of commercial illuminants from an article by Mr. Ladoff in the "Electrical World," a chart giving the same information from a paper by Professor J. M. Bryant and Mr. H. G. Hake before the Chicago Section of the Illuminating Engineering Society, and a table of comparisons from Mr. Leon Gaster's Cantor Lectures on "Modern Methods of Artificial Illumination," the author said: Herr L. Bloch, of Berlin, in a communication to the "Electrical World," has given the following

Practical Values of Consumption with Most Usual Lighting Methods.

Sources.	Consumption per Square Foot per Foot-Candle. Street Illumination. Watts.	Interior Illumination. Watts.
Carbon-filament lamps	0 9 –1 3	0 55–1·3
Nernst and tantalum lamps	0 4 –0 65	0·25–0·65
Metallic filament lamps	0·28–0·45	0·17–0·45
Ordinary direct-current flaming arc lamps	0·17–0·28	0·17–0 33
Direct-current flaming arc lamps	0·55–0 13	..
	Cu. ft. per hr.	Cu. ft. per hr.
Vertical incandescent gas-lamps	0·016–0·024	0·012–0·024
Vertical incandescent pressure gas-lamps	0·012–0·024	0·008–0·016
Inverted incandescent gas-lamps	0·010–0·018	0·008–0·016

The electric man has never been backward about rating his product in the manner best calculated to show its best figures. It so happens just now that the Mazda lamp unshaded throws nearly one-half its light above the horizontal; therefore flux of light or total lumens is pronounced the proper measurement. It will be urged that properly-designed reflectors re-direct the tungsten rays so as to minimize the loss by its natural upward tendency, though it was previously overlooked that the same method most effectively corrected a like tendency of the upright mantle's light. We, however, are not obliged to give this much consideration, as the inverted mantle is the one we are now principally concerned with; and this has an ideal natural light curve. It is a very positive advantage to be free from reflector shades; and it is well to get the idea firmly impressed that, with the inverted mantle, we relieve ourselves of a burden ever present with the metallic filament lamp.

The carbon bulbs, the various arcs, and the Nernst glowers having fallen short of bringing about the promised domination of the lighting situation, it is time to expect an attack of some sort; and for a broad-side volley we have found nothing in the published records that compares with the "Report of the Committee on Competitive Illuminants" presented to the last National Electric Light Association Convention. It is only fair to state that this report has been severely criticized as exaggerated and misleading; but, despite this, it stands as the official primer from which electric solicitors are to draw their facts and deduce the argument necessary in their work.

It starts out: "Gas, which up to a few years ago was the leading illuminant, has been largely superseded by the electric light." With some magnanimity it is conceded that mantle gas-lights may be considered competitors of high-efficiency electric lamps. The inverted burner is allowed "the advantage that it directs more of the light where it is needed."

The gas arc or cluster lamp comes in for several raps, but especially because gas men concede that it requires regular skilled attention. Alleged vitiation of air and bad colour of mantles, of course, are referred to; no electric talk is ever complete without this. At this place some one forgot himself, and started to mention fire risk; but he evidently realized that this was dangerous ground, and dropped it without enlargement or the safer plan of an erasure. Difficulties of adjustment due to fluctuating pressure and changing specific gravity of gas are held to be regular trouble makers; and, lest better gas engineering correct this, Nature itself is called to task for altering the atmospheric conditions and again upsetting the painstaking work of the lamp trimmer. The conclusion is therefore forced upon the Committee that, with all these adverse conditions, no gas-lamp with proper self-respect can ever be expected to live up to more than 60 to 75 per cent. of its initial laboratory rating. They find "that a tungsten lamp having two-thirds the mean spherical candle power shown by an incandescent gas-lamp in a photometric test will, under service conditions, produce an equivalent or greater illumination than the gas-lamp, provided that the distribution of light from the two units is equally favourable. Pilot-flames are held to add 30 per cent. to the annual consumption of gas, on the assumption of one pilot for each mantle. Under operating costs, the gas charges appear to be right for the lamps taken. But if the upkeep in mantles, glassware, and labour charges are correct, there is something wrong in the maintenance. I can refer to thousands of lamps where the cost is but a fraction of the figures given. After all this, to the Committee's mind it becomes "evident that, at the usual rates for electricity and gas, the total cost of operation with Mazda and Tungsten lamps, which is also true of Nernst, Cooper-Hewitt, and Moore lights, is in reality less than for inverted gas-lamps, and is not more than two-thirds the cost with upright units."

Now let us go back for a few comments. Electricity, instead of superseding gas, has stimulated it. More light is employed than ever before, and more gas is used for lighting. This may not be true of the cities where combined utility companies throw the weight of their influence toward electric lighting. But where real competition exists, gas lighting flourishes. It does not show with the spectacular effects of electric light; but it does show on the books from which earnings are computed.

I will pass by the criticism of single-mantle burners, because that style of lamp has always had its loyal champions, and undoubtedly will continue to take care of itself. It may, however be well to mention the fact that central station companies are again seriously considering a return to flat-rates for residence lighting. Tungsten lamps, on account of their high renewal costs, will be relied on to keep consumers from wasting current, through fear of wearing out their lamps. As it is well known that many people will pay a higher total yearly amount in equal instalments each month than they will where bills increase with the shortening days, it will be advisable for gas men to keep an eye on this revival of old-time electrical proposition. On the subject of the regular inspection and maintenance of gas-lamps, we plead absolutely guilty to the charges made in the Electrical Committee's report. It is an essential feature of all good gas-lighting service. Linked inseparably with maintenance comes the question of deterioration, on which our competing brothers hang all their hopes and proofs of lower operating costs. Whatever merit the arguments adduced may have (and they are not without some foundation) is a direct arraignment, not of gas-mantle lamps, but of gas company management. The manufacturers have produced burners and mantles which will not depreciate 30 of 40 per cent. as asserted, if given the attention that their claims as revenue earners entitle them to. In gas arc lighting—and its field is the one most vigorously contested—lamps will operate at 80 to 90 per cent. of laboratory efficiency all the time, at a maintenance expense of under 25 cents per month, which amount the user will cheerfully pay himself. But effective maintenance is not secured with cheap mantles and cheap men. The greatest strength and shrewdest business judgment of the electric light business of this country to-day lies in its support of the electric lamp makers who are consistently living up to the idea of not how cheap, but how good, incandescent lamps can be made.

Let us see, though, if gas-lamps are the only ones subject to loss of light in operation, and if lamp inspection and maintenance is a gas man's burden solely. Turning to the columns of that high authority the "Electrical World," we find ample argument to the contrary.

The basis of all claims for lower cost of electric lighting as made to-day rests on the premises that electric lamps (particularly the metallic filament variety) operate at practically initial efficiency, and that gas-lamps only give two-thirds efficiency under average working conditions—about the most high-handed brand of reasoning, in view of the facts, that one can well imagine.

Getting down now to gas operating results, I will leave the single-mantle unit to those more closely in touch with this branch of gas lighting. In upright gas arcs, the two-mantle lamp may be passed by, as there is not one of them in use to a hundred four-mantle. The gas consumption of the four-mantle upright lamp never should exceed 20 cubic feet per hour when properly adjusted for most effective service; and despite the stories of our electrical adversaries, the adjustment is a very simple thing. Following the figures taken of 1000 lighting hours per year, we get a consumption of 20,000 cubic feet of gas used during burning hours. Adding pilot consumption at 0·3 foot per hour for the remaining 7760 hours, we have 2328 feet—total for the year, 23,280 cubic feet. Lamps are seldom placed at a rental maintenance charge of over 50 cents per month; and this, with gas at $1·00, makes the yearly cost to the user $28·33 at a maximum. Many lamps operate on less than 18 cubic feet per hour, and are rented at 25 cents per month. But assuming the 18 feet rate, we have an annual cost of $23·33, or less than three 60-watt lamps it has pleased the Committee to call equal to a four-mantle upright gas arc.

Several years' experience with three-mantle inverted arcs has conclusively proved that they will acceptably replace four-mantle arcs. The total lighting power has not been quite equal to the upright arc, but the better distribution has given a more acceptable visual effect on a working plane. There is now, however, on the market a more efficient three-mantle inverted lamp and actually increased candle power over the four-mantle upright, which will again greatly strengthen a gas company's lighting business. The average consumption of a three-mantle inverted arc is 12 cubic feet per hour. Taking the pilot consumption of 0·3 foot per hour, and the rental of 50 cents per month, we have an annual cost of $20·33. Maintenance cost figures secured several months ago from some fifty representative gas companies showed that this style of lamp may be rented to the user at a profit for 25 cents per month, which would reduce the cost to the consumer to $17·33 per year.

The four-mantle inverted arc, burning 15 cubic feet per hour, will take 15,000 feet in 1000 lighting hours; and adding the pilot consumption (2328 cubic feet), we have an annual consumption of 17,328 feet. At 50 cents monthly rental, the total cost is $23·33; or at 25 cents rental, $20·33.

Tabulating these figures for cost comparison with the electric lamps of "equal or greater" illuminating value, we get:

Gas Unit.	Total Annual Operating Cost 1000 hrs. Gas at $1·00; Rental 25 to 50 Cents per Month.
Three-mantle inverted arc	$17·33 to $20·33
Four-mantle inverted arc	20·33 to 23·33
Four-mantle upright arc	23·33 to 28·33

Electric Unit.	Total Annual Cost 1000 Hrs. Use. 10 Cents per kw.
Three 60-watt Mazda-Holophane	$23·72
One 250-watt Mazda-Holophane	29·78

To ascertain to what extent the arbitrary assumption of equality for certain electric units with gas arc lamps on the score of illuminating power is justified by the facts, we will look over the following table of candle power and lumen values.

	Spherical Value.		Lower Hemispherical Value.	
	Candles.	Lumens.	Candles.	Lumens.
Three-mantle inverted arc	296	3720	439	2760
Four-mantle ,, ,,	302	3800	432	2717
Four-mantle upright ,,	240	3016	357	2245
Three 60-w. Mazda-Holophane	40 each	1494 (total)		750
One 250 ,, ,, ,,	175	2168		1090
One 400 ,, ,, ,,	280	3470		

24·1 spherical candles per cubic foot of gas.
0·66 spherical candles per watt of current,
241 candles for 1 cent (gas cost only).
66 candles for 1 cent (current cost only).

The above figures have margin enough to permit the pet one-third depreciation of the electric advocate on the gas arc, and still leave a very comfortable balance over the 100 per cent. value of the "equal or greater" three 60-watt or one 250-watt Mazda. There really is not much needed by way of argument. The figures are plain. They have all been taken from recognized authorities; and the inverted gas-lamps have the still further advantage of a natural downward distribution without the use of reflectors. Gas-lamp efficiencies are becoming greater, mantle efficiencies are increasing, costs are decreasing, and gas is selling at lower rates. Supplement this with recognized superiority in colour, low intrinsic brilliancy, better diffusion, and ideal natural distribution of the modern inverted gas-lamp, and the future of gas lighting cannot be considered imperilled.

ILLUMINATING ENGINEERING AND ITS APPLICATION TO THE GAS INDUSTRY.

By E. Leavenworth Elliott.

In discussing this subject, we propose to use the term illuminating engineering in its broadest possible sense. The meaning of the term has been often misunderstood, and in some cases misrepresented. Illuminating engineering is the application of modern scientific methods to the subject of lighting. In its broadest sense it is a systematic effort to secure the best possible illumination with the facilities available and under the conditions prescribed. Its purpose is to substitute the application of fixed laws, with the resulting certainty in results, in place of the old rule-of-thumb practices with the chances overwhelmingly against the guess being right.

To deny that there is a large and legitimate field for illuminating engineering in gas lighting, is to assume that there is no further room for improvement in the production or use of gas-light—a proposition which it would be difficult to maintain. Yet, in face of its evident absurdity, the statement has been repeatedly made. To the outside observer, it appears that there is no part of the general field of illumination which is in such urgent need of illuminating engineering as gas lighting. This is due partly to the inevitable effects of time. Gas lighting is something over a century old. Its pioneers and immediate successors are now veterans. There is no use denying the fact that there comes a time in the life of every individual when he ceases to grow intellectually—just as surely as the time comes when he ceases to grow physically. It is a simple recognition of this eternal law of Nature, rather than any reflection upon the individual, to state that gas lighting, by the simple fact of its century of existence, contains a considerable personal element which has outlived the period of mental expansion. On the other hand, the chief competing illuminant electricity has been born and grown up within the memory of those still far this side of the turning-point in their mental outlook. It is an industry of young men. The electric lighting interests, being young and eager for the fray, have taken advantage of every improvement and device afforded by science or art to push their lines forward, and have been keen to detect any weakness in the lines of their enemies. Illuminating engineering afforded a potent weapon with which to wield their fight for supremacy. Engineering is based on commercial economy; and since economy was the one stronghold of gas-light, any means of off-setting this advantage was particularly welcome. Hence the immediate acceptance of illuminating engineering by those at the front in the electric lighting field.

Let us again revert to our opening statement that we propose to treat the subject in the broadest possible manner. We claim illuminating engineering as an art as well as a science. Better lighting may mean better-looking lighting fixtures, as well as more efficient light production. It may mean an illumination more agreeable to the general sense, as well as an illumination that is less expensive to maintain. It takes into consideration the artistic, physiological, and psychological problems connected with light, as well as the mechanical and economical problems. It considers quality as well as cost.

When the electric light first made its appearance in a form adaptable to domestic use—*i.e.*, the familiar incandescent bulb—electric fixtures were contraband, and were stealthily made in the cellar or garret, and kept in a room safely locked, to which admittance was to be had only by the trusted initiated few. But the promoters of the new light were wise. They secured the choicest works of art in fixture design that it was possible to obtain; the foremost jewellery designers being called upon for the purpose. The electric lamp thus made its *début* in the most fascinating garb procurable. It made a "hit," and has been "hitting it up" at a lively pace ever since—a pace so lively, in fact, that it has left its competitors breathless, and wondering how it all happened. In the course of one generation, the electric fixture has emerged from its initial hiding-place, and occupied the field alone, so far as artistic quality is concerned. This does not mean that there are no artistic gas-fixtures; but such as there are, are adaptations of electric designs.

It is the practically universal opinion to-day among users that gas lighting is necessarily inartistic—at least, as compared with electricity. Here is the point where illuminating engineering with gas ought to begin. The user must be shown that it is possible to obtain as artistic fixture designs with gas as with other illuminants. This requires two things. The artistic fixtures must be actually designed and made, and the consumer must be made fully aware of the fact of their existence. The fixtures will be produced by the manufacturers when there is a sufficient demand to justify the effort; and this demand must be wholly created by the gas-lighting interests. It is immaterial to the fixture trade for what illuminant it makes fixtures; and it cannot have any possible interest in promoting one more than another. The initiative must be taken by the gas people.

The question of better fixtures may be considered under two rather distinct heads—the replacing of old and out-of-date fixtures, and new installations. Lighting fixtures are essentially a part of the furnishing of a room; and they go out of fashion just the same as furniture and carpets. Being less easily removed and less attention being given to them by the householder, however, they very commonly outlive two or three generations of decorative styles in the other furnishings. The black-walnut dresser or table with a marble top, and the wooden bedstead with a headboard towering to heaven, are now rarities; but the old gas-chandelier contemporary with this period of furnishing may still be found in abundance. A change of fixtures is usually an opportunity for changing from gas to electric light. So common is this feeling, that many an old-time fixture is retained, not because the cost of a new fixture would be prohibitive, but the additional cost of electric wiring raises the total to a prohibitive point.

Gas-light has been practically routed in this country from the largest commercial buildings and industrial plants. Its one remaining stronghold is the private house; and this stronghold is being vigorously attacked by competing illuminants. No more effective means of insuring the continuance of the use of gas lighting can possibly be devised than the installation of high-class lighting fixtures equipped with the best modern gas-lamps and accessories. This is practical constructive illuminating engineering. It is a common practice for the electric companies to wire and equip houses at cost, or at the lowest possible charge, and allow the consumer to pay the bill by instalments. The logical course for the gas company, either for the defensive or offensive propagation of business, is to make a similar offer for the installation of modern fixtures and appliances in place of the inefficient, inartistic, and back-number fixtures now so common.

In the case of new installations there is unmistakably a growing tendency on the part of architects to specify only electric fixtures, except, perhaps, in the kitchen, where gas must be provided for cooking. This, of course, eliminates the additional cost of gas-piping which would be required if both illuminants were provided. Though the amount is a trifling percentage of the total cost of building, it amounts to something, and may enable the architect to put an extra flourish on the outside of the house where it will show up his skill. Now that there is no necessity

for providing gas in all the rooms as an emergency equipment, the argument has added plausibility. Finally, the combination fixture as generally provided is equipped with so-called candles, using ordinary gas-flames, which are neither artistic nor efficient.

The first effort of the gas interests should be to educate the architects up to the possibilities of modern gas lighting from the artistic and economic standpoints. Next, to create a sufficient demand to induce the fixture manufacturers to design fixtures in accordance with these principles; and, lastly, to educate the householder himself in regard to the general subject of illumination. If combination fixtures so designed as to enable each illuminant to be used to its best advantage were installed, gas might well take its chances; but under present conditions, the contest is too often an unequal one.

While it would be a comparative waste of effort to attempt to supplant electric light with gas-light in the best class of commercial buildings, there is no occasion to abandon the field in the less pretentious cases; and such instances are not confined to third or fourth rate buildings. There are innumerable cases in which gas-lighting would be used if it were not for the generally held opinion that it brands the place as second-class. If it were understood that gas-lighting installations could be used which the observer would never discover were gas, it would go a long way toward securing favour for commercial use. From the illuminating engineering standpoint, nothing is easier to do than this. In fact, it is a settled principle of illuminating engineering that the source of light itself should not be visible—all modern light-sources being too dazzling for direct view. This being the case, there is no reason for the observer knowing what illuminant is used. Now that the incandescent electric lamp seems destined to rapidly displace the carbon arc for interior illumination, the distinguishing differences between gas and electric light—viz., the colour of the light and appearance of the lamp—will disappear. As to colour, there is no practical difference between the tungsten lamp and a good incandescent mantle.

The great improvement in efficiency of the tungsten lamp over the carbon lamp has made the most serious inroad into the economical advantage of gas lighting that has yet occurred. This will be partly off-set by the recent great improvements in mantles. But, even so, if gas is to maintain its advantage in economy to a sufficient extent to off-set the advantages in convenience and the sentimental value attached to electric light, it must utilize its economical lead to the utmost limit. This means that illumination by gas must be handled with the most careful and competent illuminating engineering. The comparitive efficiency of illuminants is being more discussed than ever, on account of the recent improvements in electric lamps; and while gas still holds the advantage in efficiency as a means of producing light under the majority of conditions, the advantage is not so great that it cannot be completely off-set by differences in engineering. There is no denying the fact that the tungsten electric lamp, installed on the proper illuminating engineering basis, can beat the average gas installation installed on the old guesswork plan. There is also no denying the fact that at equal cost electric light would be invariably chosen.

Broadly speaking, gas will continue to be used as an illuminant just as long as it is materially cheaper than other illuminants, but no longer. If the time ever arrives when electric light is as cheap as gas under all conditions, gas-light will disappear like the whale-oil lamp. There is no immediate prospect, however, of such an eventuality; nor should it be inferred from this possibility that economy is the only argument to be put forward in precept or practice. On the contrary, the supremacy of electric lighting at the present time is due in no small measure to the failure of gas lighting to put forth its other merits. In quality of illumination produced, gas-light is still the peer of any illuminant; and in its artistic possibilities there are but very few cases in which it cannot fully hold its own. Illuminating engineering deals with both of these elements—in fact, insists upon quality to an even greater extent than economy. Let no one delude himself with the notion that illuminating engineering consists alone in mathematical formulas and photometric curves. While a knowledge of the theoretical basis of the subject is essential to the handling of some of the more difficult problems, the technical knowledge required for all ordinary cases can readily be acquired by anyone who is reasonably familiar with arithmetic. The case is much simplified with gas for the reason that there is practically only one light-source to deal with—the incandescent gas-lamp. The principles are exactly the same whether the lamp contains a single mantle or a cluster of mantles.

The proposition amounts to this: Illuminating engineering when applied to gas-light means that each installation will be put in such a manner as to give gas all the advantages of which it is capable in economy, appearance, and quality of illumination produced. This result cannot be obtained without such a familiarity with the subject of lighting as may fairly entitle its possessor to be called an illuminating engineer. As to its relation to the gas industry, it is precisely the same relation which efficient service in any business bears to the success of that business. Gas-lighting will undoubtedly continue to be used for some time to come on the old hit-and-miss basis; but the more intelligently it is utilized, the longer will it lead a prosperous existence. Between doing a thing in the best possible manner, and in just doing it somehow, there is a wide difference, which generally measures the exact distance between success and failure. If it is admitted that gas lighting could be better done than it generally is at present, then it must also be admitted that it has need of illuminating engineering. To claim that it is not in need of this use of applied science can only be justified for one of two reasons—either gas lighting is now being done perfectly without such aid, or it is too far gone to be resuscitated.

VENTILATION OF FUEL-GAS APPLIANCES,

By James H. Walker, of Milwaukee.

The necessity for ventilation of fuel-gas appliances, when applied to domestic ranges, water-heaters, and other gas apparatus used in households, has, in the past, been a subject over which there has developed considerable controversy between appliance manufacturers, dealers, and gas companies. Gas engineers, as a rule, admit the necessity; but the commercial interests represented by agents and solicitors, by following the line of least resistance in the solicitation of business, have very often found insisting upon a flue connection, with the cost of same added to the appliance, to be a barrier to the sale. The suggestion that it was desirable, but not a necessity, furnished an easier way to the completion of the sale than to insist upon the installation. This condition has been almost invariably accepted by the gas company, rather than open a controversy with the consumer and allow an opportunity for a countermand of the order.

As most of the household appliance sales are made in the spring or early summer, when doors and windows are open during the cooking hours, the ventilation has taken care of itself, and the lack of a flue connection was not noticeable to any great degree. But as soon as the weather became unfavourable for these conditions, the existence of bad or no ventilation had an appreciable effect on the physical condition of the operator, which in many cases would be attributed to a slight disturbance of general health, and not to the real cause. A continuation of these ailments and a noticeable change in the operation of the burners, especially in the oven, would bring a complaint to the gas company that the appliance was not giving as good results as when first installed, that the odour from the gas was disagreeable, and that the oven did not bake as it had baked in the summer months. The complaint man, in nine cases out of ten, would lay the blame on almost anything except bad ventilation. I thoroughly believe that any gas company will find, by analyzing the work of the complaint department, as far as domestic appliances are concerned, that a large increase in complaints is registered at the opening of the fall and winter season, and that many complaints which seem trivial and uncalled for would be eliminated if due attention were given to proper ventilation.

The results of improper ventilation are quite noticeable by the odour of unconsumed gas, due to the fact that the products of combustion remain too long in proximity to the flame, causing what is commonly termed "floating." Other direct evidence of lack of proper ventilation is the presence of grease and soot on the walls, and, worse than all, a languid condition of the operator, and a disinclination to partake of the meal that has been prepared. The desirability of an all-year gas-kitchen, for increasing the domestic consumption, is an unquestioned fact; and the delay in attaining this result is, I believe, due to improper installation of appliances with regard to the removal of the products of combustion, fully as much as to the many excuses given by consumers for discontinuing the use of gas during the winter months. The public desires to use gas for the many advantages it offers; but the precedent set by many gas companies in not insisting on proper flue-pipe connections on all apparatus, has brought about the conditions named above, which have been a poor but lasting advertisement of gas appliances.

The proper ventilation of industrial gas appliances is a foregone conclusion (made absolute by the greater quantity of gas consumed), not only for the effect it may have upon the health of the workman, but upon the proper combustion of the gas. In operations where high temperatures are to be maintained, the combustion chambers are often necessarily limited in space; and as a large quantity of gas must be taken care of in a limited area, you will readily see the necessity of removing the products of combustion the instant they are formed, if we are to maintain the efficiency of the flame. The lack of proper and rapid ventilation and too limited area of combustion chambers has as often lowered the efficiency of a gas appliance as the lack of insulation or faulty workmanship.

The great value of proper ventilation was most thoroughly impressed on my mind during experiments conducted in the past year which resulted in successfully placing upon the market a new type of commercial gas-range, constructed without any burners directly under the top—the flames only being allowed to occupy the combustion chamber. By a proper flue connection, I am enabled to obtain a flame issuing from a $\frac{3}{4}$-inch opening of a specially constructed burner from 18 to 24 inches long, consuming 18 cubic feet per hour, and maintaining its integrity for its full length, with a high efficiency, and without the use of applied power as in so-called blast-burners. The flame being horizontal, I maintain that the high-efficiency produced, and the extremely favourable results as compared with the best quality of hard coal, are largely due to, and depend to a great extent on, the prompt removal of the products of combustion. That high efficiency is attained is unquestionable, as the results of about twenty-five different installations of the range warrant the statement to prospective customers that gas at 80 cents per 1000 cubic feet is cheaper than anthracite coal at $7 per ton. But to accomplish this, we insist upon proper ventilation.

PRODUCTION OF POWER FROM GASES.

Lecture by Professor Burstall.

On Monday of last week, Professor F. W. Burstall, M.A., delivered in Birmingham the first of a course of six lectures on the "Production of Power from Gases" to the Midland Junior Gas Association, under the auspices of the Midland Association of Gas Engineers and Managers; a large number of members of both the Senior and Junior Associations being present. The following is an abstract of the lecture.

Before considering the production of power from gases it is necessary for me to enter into the composition and properties of gases in some detail, for the reason that the majority of my audience are familiar with gas from the point of view of its candle power. In the production of power, this is quite a secondary matter. Town gas I do not intend entering into for a moment, beyond indicating its properties; for town gas is only one method of obtaining a gas suitable for power. I may say that in future, when I use the term "gas," I shall refer to town gas; when I use a prefix it means a gas manufactured by a particular process other than that with which you are familiar.

Table I.—*Analysis and Products of Combustion of Coal Gas by Volume.*

Mean of Eight Samples.

—	Per Cent.	Carbonic Acid Produced.	Oxygen Required.	Steam Produced.
Carbon dioxide . .	0·16	0·16	..	..
Heavy hydrocarbons	4·48	13·43	20·93	15·0
Oxygen.	0·13	..	..	..
Carbon monoxide .	9·46	9·46	4·73	..
Marsh gas	33·67	33 67	67·34	67·34
Hydrogen	43·40	..	21·70	43·40
Nitrogen	8·70	..	..	..
Totals . .	100·00	56·72	114·70	125·74

Table II.—*Heating Value of Coal Gas.*

The Heating Values are taken less the Latent Heat of Water Vapour, and are in Calories.

—	Per Cent. By Volume.	Heating Value of one Cubic Metre at 15° C., 760 mm.	Heating Value of Each Constituent in 1 Cubic Metre of Coal Gas.
Carbon dioxide . .	0·16	..	..
Heavy hydrocarbons.	4·48	20,090 Calories	900 Calories
Oxygen.	0·13	..	..
Carbon monoxide .	9·46	2,878 ,,	272 ,,
Marsh gas	33·67	8,030 ,,	2,704 ,,
Hydrogen	43·40	2,440 ,,	974 ,,
Nitrogen	8·70	..	..
Totals . .	100·00	..	4,850 Calories.

Table No. I. gives the composition by volume of a coal gas. It gives the percentages of the various substances, and the results which are obtained when the gas is burnt with a definite quantity of air. We find that 100 volumes of gas produce 56·7 per cent. of carbon dioxide, require 114·7 volumes of oxygen, and produce 125 volumes of steam. Air consists approximately of 20 per cent. of oxygen and 80 per cent. of free nitrogen. Hence, to burn 100 volumes of gas will require approximately 550 volumes of air; and there will be nothing left but inert nitrogen, carbon dioxide, and steam. Before I proceed, I would like to show you the way of estimating the heating value of these gases—that is to say, the heating value of each constituent is taken as a percentage of each, thus obtaining the heating value of any named volume. This particular gas is 540 thermal units to the cubic foot; the lower value, of course, being taken.

Now I would like to go on to allude to some of the possible gases which can be used for the production of power. First, there is coke-oven gas. This differs from the ordinary gas inasmuch as it is produced at a higher temperature, and over a longer period of time; the general average for the production of hard coke being thirty hours, at a temperature of about 1300° C. It differs, again, from ordinary gas in that the percentage of hydrogen is higher and that of methane is lower; and the percentage on the heavy hydrocarbons is much lower. It is about 400 thermal units to the cubic foot.

The next gas of importance differs materially from ordinary gas, and is known as producer gas. There are a number of producer gases, according to the particular fuel from which they are derived. Table III. gives an ordinary suction gas derived from an anthracite producer; and you will see that there is a material difference between these two gases, leading to very different results. Carbon dioxide, from being a trace in coal gas, amounts to 6½ per cent.; carbon monoxide, from 10 per cent., is raised to 20 per cent.; methane, falls to nearly 1 per cent.; and hydrogen, from 40 per cent. to nearly 10 per cent. It is apparent that these gases have a much lower heating value than ordinary

Table III.—*Analysis and Products of Combustion of Suction Gas on Anthracite.*

—	Volume Per Cent.	Carbonic Acid Produced.	Oxygen Required.	Steam Produced.
Carbon dioxide . .	6·5	6·5	..	..
Oxygen	0 5	..	−0·5	..
Carbon monoxide .	20·8	20 8	10·4	..
Marsh gas	1·2	1·2	2·4	2·4
Hydrogen	15 5	..	7·7	15·5
Nitrogen	55·5	..	..	..
Totals . .	100·0	28·5	20·0	17·9

gas. As a matter of fact, gas in the case quoted has a heating value of 130 thermal units to the cubic foot.

In addition, there is producer gas derived from bituminous coal, either with or without ammonia recovery. In the case of non-ammonia recovery, the gas has an average heating value of 160 thermal units; with ammonia recovery, the value is lower—namely, 140 thermal units to the cubic foot.

There remains one other gas which, though extremely poor, is yet going to be one of the gases which will play the largest part in the future development of the gas-power industry. I refer to blast-furnace gas, which is a bye-product in the manufacture of iron. An analysis is given in Table IV.

Table IV.—*Analysis and Products of Combustion of Blast-Furnace Gas.*

—	Volume Per Cent.	Carbonic Acid Produced.	Oxygen Required.	Steam Produced.
Carbon dioxide . .	3·5	3·5	..	..
Oxygen	0·2	..	−0·2	..
Carbon monoxide .	33·1	33·1	16·55	..
Marsh gas	0·2	0·2	0·4	0·4
Hydrogen	3 9	..	1·95	3·9
Nitrogen	59·1	..	..	..
Totals . .	100·0	36·8	18·7	4 3

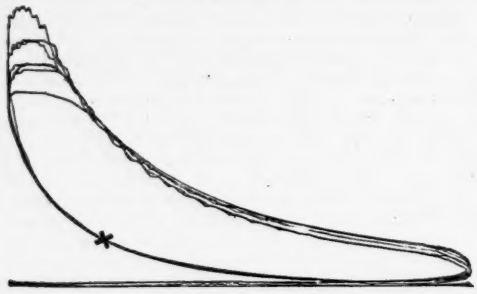
If we consider the quantity of air required to burn these various kinds of gas, we shall find in the case of producer gas about 1·1 volumes of air are sufficient to burn 1 volume of gas; and with blast-furnace gas, less than 1 volume of air is sufficient to completely burn the gas. In the actual use of gas in the cylinder of a gas-engine, we do not attempt to work close down on the air necessary to burn the mixture, for two reasons. The first is, if you make the balance so very narrow, you may get insufficient air to burn the gas, with the result that the charge would not explode. When the explosion is very violent, it is likely to put an excessive strain on various parts of the engine. Hence the average charge for coal gas is 9 volumes of air to 1 volume of gas—leaving a surplus of air for the charge to explode. In the same way when working with producer gas, we have from 1½ to 2½ volumes of air. With blast-furnace gas we work with from 1 to 1½ volumes of air; the point being that we should try to get into the engine cylinder the same quantity of heat units in a given volume. It makes no difference to the working of the engine which of these gases we are dealing with, provided the air is proportional and so adjusted as to give the same quantity of heat in a cubic foot of the mixture.

Now in case I may be misunderstood, let me say that you will find in almost every case an engine on suction gas is given a larger cylinder for a given power than for ordinary gas. The reason is not because you cannot get the same power, but because the unhappy suction-gas producer is in the habit of tiring at the end of a day's work. Hence you must make allowance, and have a good margin. On town gas you can ensure constant heating value all day, year in and year out. For this reason, suction-gas plants are given bigger cylinders to make up for the large variation in the quality of the gas.

Now that we can get so far as to illustrate the fact that the important point is the quantity of heat per cubic foot of mixture, I will say something as to the phenomenon of explosion.

Let me go a little into detail as to what happens when an explosion takes place in a closed vessel. We will assume that we have got a mixture of gas and air in the proportions in which they will ignite. The next phenomenon is to produce a temperature which must be somewhere in the neighbourhood of 500° C., in order to ignite this gaseous mixture. By ignition, we mean this—that the molecules or tiny atoms of hydrogen and methane must be supposed to be floating about in this gaseous mixture, with some tiny atoms of oxygen in their neighbourhood. Well, if you only heat up the most minute portion of this gaseous mass, the molecules of hydrogen and oxygen will join together, and will generate a material quantity of heat. Not only will they generate it, but they will spread it to their neighbours. And so the ignition or combustion will spread through the gaseous mass. Now the rapidity with which the explosion takes place has been measured; and it is found that, with an ordinary mixture, the explosion will travel with a velocity of 8000 yards per second, which is, of course, an enormous velocity. However, in the case we are considering, the velocity with which the explosion spreads is

nothing like so rapid, because for certain reasons we find it desirable to compress the gaseous mixture before we ignite it.



On the diagram (which is a copy of a photograph direct from an engine), I have marked with a cross the point at which the ignition-spark passes across the gap of the sparking-plug. These are three successive charges; and I want you to notice for a moment the fact that the piston had gone quite a long way along the stroke before the pressure started to fall. To give some idea of the time which it would take, I would say that the engine was making 165 revolutions per minute—that is, 330 strokes—which corresponds to the time of a stroke being about one-fifth of a second. Taking into account that the piston moved comparatively slowly at first, you have the curious and interesting result that inflammation commenced before the end of compression, and did not finish until well down the stroke. Hence the explosion took a material time before completing its work. This is a very important point, and one which must be perfectly clear to anyone who is going to have anything to do with practical gas-engine troubles, because it appears again and again in very awkward forms. Probably the sort of phenomenon which takes place is that at the point of ignition the temperature is about 180° C. (materially hotter than boiling water), when the spark passes the portion of the gas in immediate contact with the ignition plug, burns, and, radiating out from the igniter, starts what is called an explosion wave. When the wave meets an obstacle, it is deflected. In a simple form of breech, the ignition-plug is in the centre of the end, and at the particular moment that we pass the spark, the combustion starts, radiating out from the centre, and producing the explosion wave, which goes on and on, always in a spherical form, until it strikes the piston. It rebounds from the piston, and rebounds here and there into all corners; and, finally, by the time you have got to the expansion line, the whole charge has become ignited.

Starting from the temperature which I have alluded to, of about 180° C., this addition of heat finally gives a mean temperature which we certainly know is not less than 1600° C. Terms of this sort have no meaning whatever as regards temperature. All we can do is to compare them with some temperature we know something about; and, to give you an illustration, I would say ordinary iron run from a cupola is about 1300° C. To the reflecting mind, this suggests the questions: "How can you produce and maintain such a temperature in an iron vessel? Why do you not melt the side of the vessel?" The reason is because the whole mass of the charge is not at the same temperature. The explosion wave, when it spreads and hits the piston, becomes cool; and wherever it hits the metallic surface it parts with its heat so rapidly that it cannot keep up a high temperature. This operation I know, because I have measured it. While you have a temperature in the centre of the hot gas of probably 1600 to 1800° C., you have a temperature near the metal which probably does not ever exceed 200° C. It is rapidly cooled by the metallic surface; and the temperature of this metallic surface is probably in the neighbourhood of 80 to 90° C., and is never exceeded. This is an important point, because it makes clear certain phenomena which would not take place unless we were performing our operations in a conducting cylinder. If we were performing them in a non-conducting cylinder, we should get so enormous a temperature that nothing would ever withstand the shock of explosion.

Discussing the actual detail of how power is obtained from gas, Professor Burstall described each set of operations that take place in the four-stroke cycle, at the same time explaining, so far as was possible within the scope of the present series of lectures, the reasons for them. He then proceeded: To only have one explosion to any four strokes or two revolutions, is obviously very defective as compared with the steam-engine, in which you get a much more even sequence; and this led to the attempt to get engines in which the explosions occurred more frequently. The most important of these is what is known as the two-stroke cycle, which was invented by that eminent engineer, Mr. Dugald Clerk. In the two-stroke cycle, we get a set of operations very similar to the four stroke, excepting that the charge is forced into the cylinder by independent gas and air pumps before the exhaust is over and before compression has started. The rest is exactly similar to the four-stroke cycle, so that you eliminate two strokes of the four-stroke cycle. But you have a very defective set of operations—perfect theoretically, bad practically. There always comes a time when the two valves are opened at once, with the result that some of the gas goes straight through and out of the exhaust-pipe. This is the principal defect in the two-stroke cycle. It does not apply to oil, because that can be injected into the engine in a liquid form, and there is no possibility of it getting from the inlet-valve into the exhaust-valve. This is the reason why the new Diesel oil-engines are being very widely made on the two-stroke cycle.

Now having discussed the matters of combustion and cycles, I want to pass on to the question of how the governing of a gas-engine is effected. There are three ways. The first is the hit-and-miss method. By hit-and-miss we mean that, if the engine is running too quickly, the gas is never allowed to go into the engine at all. The air-valve opens, but no gas goes in, with the result that no explosion follows. If, on the other hand, the engine is running too slowly, an explosion is introduced to accelerate the fly-wheel. This has the advantages of extreme simplicity and reliability. Unfortunately, however, it is not sufficiently steady for many of the operations which modern industry requires, where considerable regularity of speed is essential. Hence two other systems have been brought into operation. They are known as quantity governing and quality governing.

By quantity governing is meant that the gas charge is kept at a constant ratio of air to gas. You arrange your mixing-valves so that the quantity of air shall bear the same relation to the quantity of gas, whatever the load on the engine. It has this great advantage that, the charge being of constant composition, the spark will always fire it. It has the disadvantage that, under certain conditions, it is possible to reverse the direction of stress on the various parts, and thus produce a rattle. Now the rattle is of no importance in the case of small gas-engines—that is to say, under 100 H.P.; but when you come to a large engine, a reversal of shock becomes a serious matter, in that it shortens the life of the engine. For this reason, practice has recently been to adopt the other method of governing—quality governing.

The idea is to get an air supply constant, and to vary the amount of gas which goes into the engine cylinder; and therefore you vary the violence of the explosion. This system is absolutely perfect, but for one slight drawback. When you get the gaseous mixture weaker and weaker, your gas gets to a point when it is so weak that the spark will not fire it; and this generally comes about in the case of ordinary gas when you have about 14 volumes of air to 1 volume of gas. Then the charge is so weak that it will not ignite, and, of course, the charge passes out to the exhaust, and is lost altogether. Hence many of the Continental makers have adopted a system of partly quantity and partly quality governing, though all the English makers have adopted quality governing, and have no difficulty in governing-down from full-load to even one-quarter of full-load; so that this difficulty does not become one of serious character.

The Professor next gave an account of how a gas-engine differs in construction from a steam-engine; and he concluded the lecture with some remarks on premature ignition and back-firing.

Premature ignitions are very dangerous; but they are quiet. Back-firing is very noisy, but harmless. Premature ignition is produced in this way: Some little point gets a very small speck of dirty oil, tar, or dust, or anything of that sort; and it gets red hot. Instead of the charge being fired by the spark at the proper time, it gets fired by this little point; and a very small point is sufficient. The effect will be that the pressure begins to go up far above the usual pressure. If this is allowed to continue, something will go. A back-fire is an explosion in the air-pipe. It means that there has been some gas left behind in the cylinder. It is a very easy thing to get pockets of gas that have been left smouldering from the last charge. Then when the new air and gas come in, in place of waiting for compression, the whole thing fires-back into the air-pipe with an appalling noise. You would think something very serious had happened; but it is perfectly harmless. It cannot go into the gas-pipe, because there is no air to support combustion. The first phenomenon—that of premature ignition—is very difficult to guard against, because it is extremely hard to keep the walls so clean that ignition will not take place. What I want to emphasize is that it is this liability to premature ignition which makes it absolutely essential that gas-engines shall be fed with perfectly clean gas. Town gas has always been clean; but when you come to producer and blast-furnace gas, the same conditions do not apply. They are produced in such huge volumes that you cannot purify them in the same manner as town gas; and it is not unfair to say that many of the difficulties of gas-engines on producer gas have been because the gas was not sufficiently clean. With blast-furnace gas, which, of course, contains no tar whatever, but often contains dust, the same difficulty is experienced. The dust tends to accumulate in the engine cylinder. It goes on from stroke to stroke; and though only a minute portion is deposited in any particular stroke, if you are working for a long time you soon get considerable quantities of substances red hot, ready to set up premature ignition at any time.

Among the awards this year by the President and Council of the Royal Society of which the King has approved is the Davy Medal to Professor Henry E. Armstrong, F.R.S., for his contributions to chemical science.

The effect of lightning on concrete, which has long been a matter of dispute, has been observed by a leading member of the American Society of Civil Engineers, who has a reinforced concrete water-tank on his country estate. This was struck by lightning, which did not cause any injury, but changed the texture of the concrete in places from granular to vitreous. The tank was heavily reinforced.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Old Kent Road Gas-Works.

There was a large muster of members of the London and Southern District Junior Gas Association on Saturday afternoon, to take part in an inspection of the Old Kent Road works of the South Metropolitan Gas Company. It was not the first visit paid by the Association to these historic works—a previous one having taken place just about three years ago—but there were on the present occasion some things which were not there before, and what they had seen previously the members were delighted to have an opportunity of inspecting again.

On arriving, the party were met in the Livesey Memorial Hall, by the Company's Chief Engineer, Mr. W. Doig Gibb. Mr. Gibb, in welcoming the Association to the Old Kent Road works, said he felt he owed the Association an excuse for not having met them before, as he had now been in London for two years; but they would agree with him that, in coming as a stranger to a works of the magnitude of those of the South Metropolitan Company, it was wiser that he should take pains to know the innumerable details of his own business rather than take up other people's. However, he hoped to atone for this, and to attend some of the meetings of the Association, in which he took a great interest. He had just a word for the younger members. No good job ever came along to young men who were not ready, so it behoved all to be prepared for the test. When at Newcastle, he had always taken an interest in educational work in connection with the industry; and it was for this reason, perhaps, that he became one of the Examiners for the City and Guilds Institute. He was then at the outset very much struck with some of the theoretical questions that were set in the examinations; and he thought that, looking at it from an all-round point of view, it would be better for the student who failed to pass the examination in one year that the Examiner should be changed every year or two, so that the student would not have a repetition of the theoretical questions at the next time of sitting. With regard to the visit that day, they remembered that the works were old, and had come together gradually, until the site was filled. It was not like laying out a large works in a big field. If the Association would, however, come to East Greenwich, they would there see a well-planned gas-works; and he gave them a hearty invitation to visit the works when they were drawing out a future programme. He hoped to be with their Council at De Keyser's Hotel next Saturday, in connection with the visit of the Midland Junior Association.

The President (Mr. J. G. Clark) then moved a hearty vote of thanks to the Company for opening their works to the Association, and to Mr. Doig Gibb for personally coming among them, and for his speech and the interest he had taken in the Association by becoming one of the patrons when coming to London from the North. The Senior Vice-President (Mr. D. J. Winslow) seconded the vote. Mr. W. J. Liberty said that, as a Past-President, he wished very heartily to associate himself with the proposal. The late Sir George Livesey took more than a sympathetic interest in the Association from its formation up to the time of his death; and this was followed up by the interest that the present Chairman, Mr. Charles Carpenter, took in it. Mr. Carpenter, they would remember, received the Association at the Old Kent Road works a few years ago. Mr. Doig Gibb became a patron of the Association even before he left Newcastle—when he found he was coming to London. He was glad they were going to see something of Mr. Gibb in the future, and thanked him in advance for his promise to be present at the visit of the Midland Junior Association, and for the help he had rendered in connection with this forthcoming visit.

The visitors were then taken in parties round the works, under the guidance of Mr. T. S. F. Gibson (who is in charge of the station), Mr. D. Chandler, Mr. J. Hewett (the Association's Honorary Treasurer), and other members of the staff. There are two sections of the works—the old and the new—which have a combined area of about 33 acres; and the members first walked down the old portion, which possesses so many close associations with the late Sir George Livesey. On the way attention was directed to the old retort-house, erected on a site which was formerly occupied by a church; and from these memories of the past, the members were brought back to the present by the plant which has been erected for the purpose of carrying out experiments in connection with the reduction of sulphur in the gas. Then the process of gas manufacture was followed round from the retort-house to the purifiers.

The coal required is brought to the gas-works in barges, *viâ* the Surrey Canal. These barges are loaded on the river at the Rotherhithe pier of the Company, from colliers running between the Thames and the Durham and Yorkshire collieries' staithes. The barges are discharged by steam-cranes, working Hone grabs, into the coal-stores, which are sandwiched between the retort-houses. The four modern retort-houses are each 150 feet long by 71 feet wide; and each contains sixteen settings of tens, or 160 retorts, which are 20 feet long, oval section, 21 inches by 15 inches inside. The retorts are heated by producer gas, which is generated in outside producers, of which there are two to each house. The charging of the retorts is carried out by compressed-air machines, and the discharging by the "Co-Partnership" hydraulic pusher. Twelve-hour carbonizing is the general rule at the works. The coke is carefully let down by means of an inclined plane to hoppers, where it is quenched and drained, before being again lowered into trucks to be carried on to the coke heap. The exhausters, driven by means of "Farey" compound condensing engines, exhaust from the retort-house governors, and deliver the gas into water-cooled reversible condensers. Then there are the Livesey washers, tower scrubbers, and oxide purifiers. From the purifiers, the gas passes through naphthalene washers containing tar oils. Instead of being housed in the usual manner, the drums of the station meters work in concrete tanks sunk in the ground. Considerable interest was manifested in the test plant, which is a complete self-contained little gas-works—right from the retort to the gasholder. In this, everything has been done to as far as possible reproduce the conditions under which the coal will be carbonized on the large scale—even to the provision of hydraulic charging and discharging machinery, for the 10-feet through retorts. The necessary hydraulic power is produced by the steam-engine that operates the other portions of the test plant.

The various shops were also inspected, including the meter-shop, where models were on view for showing the action of both wet and dry meters. The machine tools in the engineering fitting shop and the carpenters' shop were much admired. The power for these and for the blacksmiths' shop (which contains two power hammers) is derived from a 50-horse power gas-engine. Then there were the new and excellently arranged stores, covering a large area, and containing (in innumerable rows of bins) everything needed for maintenance work, as well as fires, cookers, water-heaters, &c. Repairs to cookers, fires, meters, lamps, and fittings used on the district are mostly carried out at these works. Stoves, after being baked, are subjected to the sand-blast process, and then taken into the shop, where all defects are made good.

When the inspection had been completed, the visitors were entertained at tea in the officers' dining-room. After this, the President remarked that, as an Association, they had visited the Old Kent Road works before; but that day they had seen something new. This was evidence of the great progress being made in the gas industry, which was becoming more pronounced every day. He felt somewhat impressed with the plant that was used to test the coal—so as to get an idea of the conditions necessary for its perfect carbonization, or to ascertain the results that might be expected from its use. This experimental plant was full size; and there was a machine there capable of operating a large retort-house, doing nothing more than serve this setting. It had been pointed out to them that the idea was to carry out the experimental carbonization as nearly on practical lines as possible; and the bold plan of putting in a huge machine to operate eight or ten retorts was one which commended itself to him. It showed that the Company were not content to obtain mere laboratory results. Another interesting feature was the sulphur purification process, by means of catalysis in combination with nickel compounds. This showed how chemical knowledge was being applied to the gas industry. Among the engineering features, he might refer to the ingenuity displayed in the design of the apparatus to separate the clinker from the coke. It would not be right for them to leave without acknowledging their indebtedness to Mr. Gibson and his assistants, who had done so much to make the afternoon both a pleasant and an instructive one. Mr. Doig Gibb had unfortunately been obliged to leave them earlier; but he had expressed the hope that he might be able to attend some of the Association's meetings, and he (the President) trusted it would not be long before he did so.

The Senior Vice-President of the Association then proposed a hearty vote of thanks to Mr. Gibson and his assistants for all they had done, and said that in going round the works he had been greatly struck by the excellent manner in which the Company looked after the welfare of their men. Mr. W. H. Vanner, who seconded, agreed that they had all seen something to interest them. He alluded specially to an ingenious screen arrangement in use in the retort-house for preventing the breaking up of the coke. He also referred to the experimental sulphur purification process, in which the sulphur compounds are converted into sulphuretted hydrogen, and subsequently removed. The members, he added, highly appreciated the hospitality of the Company. The vote was carried with applause, and briefly acknowledged by Mr. Gibson.

The report for the year 1910-11 recently prepared by the Inspector of Machinery in New Zealand states that gas and oil engines appear to be displacing steam apparatus, except where steam is required for manufacturing purposes. Most of these engines are imported. Certificates of inspection were issued during the year for 6212 boilers, 3206 gas and oil engines, 238 Pelton motors, and 1474 other water-engines.

In the list of Mayors for the current municipal year, we notice the following who are associated with gas or water supply: Alderman G. S. Elliott, who is for the sixth time Mayor of Islington, is Vice-Chairman of the Metropolitan Water Board; Mr. E. Finn, the Mayor of Lydd for the twenty-third year in succession, was formerly Chairman of the Lydd Gas Company; Alderman S. R. Groom, who has been re-elected Mayor of Harwich, is a Director of the Gas Company; Sir W. H. Stephenson, the re-elected Lord Mayor of Newcastle-on-Tyne, is Chairman of the Newcastle and Gateshead Gas Company; and Alderman R. Thornton, who has been re-elected Mayor of Brighouse, is Vice-Chairman of the Elland-cum-Greetland Gas Company.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Visit to the Soothill Wood Colliery Company's Coke Plant.

Though the Association had on two previous occasions inspected recovery coke-ovens, last Saturday's visit to the ovens and bye-product plant of the Soothill Wood Colliery Company, near Batley, had been anticipated with special interest, as the ovens, the washing plant, and the ammonia process were all different from those seen on the other occasions. The visitors were received at the colliery offices by Mr. A. B. Blakeley, the Managing-Director, who spent the afternoon in conducting the party round the plant, assisted by his brother, Mr. Stanley Blakeley, Messrs. J. S. Wynne and H. Thomas, representatives of the Semet-Solvay Company, Mr. J. E. Griffiths, the Coke Manager, and Mr. R. J. Williams, the Works' Chemist.

The afternoon was all too short for the many points of interest observed, though the members and their guides spent a very busy time—leaving no portion without full scrutiny and ample discussion. A few of the members present had visited these ovens on another occasion under different auspices, and others were familiar with coke-oven designs and working. These were thus able to supplement the efforts of the official guides, and so a very profitable afternoon was spent; there being neither any need for great hurry or for strained attention to explanations only partly heard, as sometimes is almost necessarily the case on visits. In fact, it was departing daylight that finally closed the visit, though even then the whole scene had a new interest and attractiveness from the varied lights cast by electric arc-lamps, and the glare from burning gas and open ovens on the masses of steam and the wreaths of mist that played round the elevated position of the colliery sweeping up from the valley below.

Before leaving, the visitors partook of light refreshments provided by the Colliery Company, whose officials and the guides of the afternoon were warmly thanked on the proposition of Mr. William Cranfield, seconded by Mr. C. Roper—the President, Mr. C. D. Cawthra having been obliged to leave somewhat earlier. Mr. A. B. Blakeley, the Managing-Director, responded on behalf of all concerned.

Description of the Plant.

The installation is a battery of twenty-five Semet-Solvay ovens, 33 ft. long, 6 ft. high, 18 in. wide, each carbonizing a charge of some 8 tons of washed small coal and dust in about thirty hours. The installation is by no means one of the latest of its type, and no attempt is made at regeneration or preheating the air. Gas and air enter from the ends of three of the four horizontal flues that heat the ovens from the sides; and the amount of air drawn in by each gas-jet can be easily adjusted by the double pierced diaphragms that are placed round the gas-pipe and across the air inlet. One or two of the ovens were under repair; and the members were interested in seeing them being relined while the neighbouring ovens were still in full work—a possibility which is one of the distinguishing features of the Semet-Solvay ovens. A good many of the visitors went into one of these, where the bricklayers were at work, in order to see for themselves what the temperature was like. As the end oven was open, it was naturally the one into which most chose to venture, as being the coolest.

All the coal dust, &c., is, of course, washed; and this part of the plant proved to be of exceptional interest, and was closely examined. About 300 tons are handled each day (ten hours working); and the washed material is drained in five circular bunkers, each of which holds a day's yield. These are 30 ft. diameter and 21 ft. 6 in. deep. As small coal is sometimes delivered as well as dust, all the washed material is crushed before passing to the charging-machine to be stamped. A batch can be filled and stamped in about twenty minutes; 54 stamps per minute being given with a ¾ cwt. iron stamp-head falling 2 feet. A 25 H.P. motor operates the charger, which, when loaded, has a gross weight of some 50 tons. The compressed charge is pushed into the oven, and an additional charge dropped in from openings in the roof of the oven so as completely to fill up the ends after the doors are luted on. An additional 9 cwt. can thus be got in. Of special interest to gas-works' visitors was the explanation given that this addition was less to secure an extra yield of coke than to prevent a troublesome deposit of carbon in the intensely heated space otherwise left where the charge tapered off. The relief thus experienced had been very striking.

Washed coal dust usually contains from 13 to 14 per cent. of moisture; and it has been found impossible to get below 12 per cent. by merely draining in bunkers. Beyond this, every 1 per cent. of moisture lengthens the carbonizing time by two hours; so at some collieries drying plant has been installed—hot air passing over the coal in a revolving cylinder. Opinions differ as to the advisability of the expedient; drying can be secured; but at the cost of incipient carbonization.

The slaking of the charge is done by a kind of movable shield, from which water at 60 to 80 lbs. pressure plays on the issuing coke. As it subsequently falls down the slope from which it is filled into railway waggons, it is further played on by a hose. Unless pretty-well slaked before it reaches the open air, the coke suffers materially in lustre, in acceptability, and therefore in price. About 1000 gallons of water are used to slake each charge; and of this half is recovered and half evaporates. The heat still remaining in the masses of slaked coke is sufficient to pretty completely dry it; and it is placed on the market containing about 3 per cent. of moisture.

The hydraulic main is divided longitudinally into three portions. Into one the gas from the ovens enters, the dip pipes only just passing into it and not being sealed. This section is under pressure, and the gas passes under the serrated edge of the midfeather through about 1½ inches of liquor seal into the second division, which is kept at a vacuum, and from which the foul main is taken off. The third division, separated from the second by a deeper midfeather, is in parts open to the air, and affords access for raking forward the heavy tar—an operation necessary, though a constant stream of liquor from a 4-inch pipe is circulating along the main. This large volume of weak liquor prevents any separation of solid ammonium chloride, which is a notable feature of the working of some Yorkshire recovery ovens where tar flushing is used. Here there are only about 11 parts of chlorine in 100,000 (as sodium chloride) in the mine water. The sump water in some West Riding pits, especially where the yield of water is not large in amount, is distinctly salt to the taste.

Much attention was paid to the ascension pipes, of which several types were seen. Those exciting most interest have a pipe of about 3 ft. 6 in. in length and 15 inches diameter, fitting into an annular lute standing on a tubular brick column. In the older type, these lutes are filled with water (freely renewed), while in the later type sand is used instead of water. In the event of the pipe becoming blocked, it can readily be removed and another inserted. To close the gas-way when the ovens are open, a Bowen valve fits across some of the gas-pipes, while in others a mushroom valve closes the end of the hydraulic main.

The foul main is also continuously flushed with weak liquor, to keep it free from obstructions. The liquor, as is usual in coke-oven practice, is only worked up to about 1 to 1¼ per cent. of ammonia; and some 55 to 60 tons of this are produced daily. Below this strength it would be difficult to handle the mass and work it up, while above this strength the liquor would suffer from loss of ammonia at open pots and in various other ways.

The gas is cooled through four annular condensers and two vertical water-cooled pipe condensers about 15 feet high, and each containing 175 pipes of 2⅞ inches diameter. It then passes through water scrubbers for the elimination of ammonia, and is finally washed with creosote oil in a rotary washer-scrubber to recover the benzol from the gas. The impoverished gas is then used to heat the ovens and a series of boilers which supply steam for the whole of the ovens, recovery plant, and the power connected with them. Practically never has any gas to be burned to waste, though the pipe for the purpose is, of course, in position for instant use.

The liquor is distilled in Walker's stills of the usual types, but is worked up not into sulphate of ammonia, but into a concentrated liquor containing about 14 to 16 per cent. of ammonia, which is then sent away by rail for use in the Solvay (ammonia-soda) process for making bicarbonate of soda. The gases from the stills are bubbled through water in a series of six vessels. All gases are thus absorbed; and though safety devices are installed, sulphuretted hydrogen is rarely found at the exit of the last absorbing vessel. The first vessel absorbs so little ammonia, owing to its high temperature, that its contents are passed to the stills, while from the others the liquor flows backwards and forwards till it reaches the third vessel, which contains the final product of strong liquor. It contains the free and fixed ammonia and the carbon dioxide and sulphuretted hydrogen of the original liquor; so it is really a strong gas liquor containing no fixed ammonia, but some chemically free, in addition to the technically free, ammonia. In spite of this method of working up the liquor, for convenience of comparison, &c., the yield of ammonia is always calculated to pounds of sulphate of ammonia per ton of coal carbonized.

The benzolized creosote oil from the washers is treated in special stills of the Solvay design, with steam and the benzol vapours expelled. These are condensed out in a superheater, and their surrendered heat made to heat up the incoming benzolized oil, which has already been partly warmed up by the heat recovered from the exhausted creosote. This creosote, when completely cooled, is, of course, again circulated through the oil-washers.

The condensed benzols separated out on top of the water from the condensed steam are passed to the store, and finally sold as crude naphtha.

The tar is not treated in any way, but is simply sold and sent away to the tar distillers.

Exhausters, pumps, &c., came in for due notice, and finally the water-softening arrangements were visited. Here some 40,000 gallons of pit water are treated daily. By means of lime and soda ash, the hardness is reduced from about 52° to 8° (nearly three-quarters of the hardness being "permanent hardness").

The boiler feed water is raised to 204° Fahr. by means of exhaust steam.

The Vacant South Metropolitan Directorship.—A vacancy having occurred on the Board of the South Metropolitan Gas Company by the death of Mr. Robert Morton, the proprietors will be asked, at a special meeting to be held next Monday, to elect a Director in his place. We learn that Mr. Laurence W. S. Rostron, son of the late Mr. Simpson Rostron (who, it will be remembered, was a Director of the Company), is a candidate for the position. Mr. Rostron is a barrister of Lincoln's Inn, and the author of "The Powers of Charge of the Metropolitan Gas Companies." He is a member of the London County Council, and represents Central Finsbury.

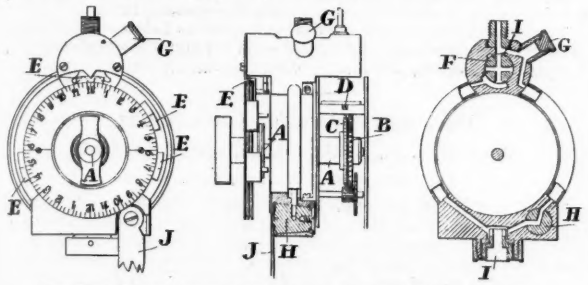
REGISTER OF PATENTS.

Lighting and Extinguishing Gas-Burners at Predetermined Hours.

GUNNING, J., of Bournemouth; a communication from Couaillet Frères, of St. Nicolas d'Aliermont, near Dieppe.

No. 23,448; Oct. 10, 1910.

This clockwork apparatus for automatically lighting and extinguishing gas-burners at predetermined hours is illustrated in front elevation, side elevation (partly in section), and cross section.



Couaillet Frères Lamp Lighting and Extinguishing Apparatus.

One feature of the construction has reference to the clockwork mechanism, as it may happen that, with a dilatory winding up, the clockwork mechanism may be stopped by reason of a recoil. To obviate this inconvenience, the arbor A, which is driven by the main spring, instead of being clutched directly to the toothed driving wheel B, which is loose on the arbor, is resiliently clutched to it by a device similar to ratchet-wheel and clockwork mechanisms used in connection with watch barrels. As the winding-up movement proceeds by turning the arbor in the proper direction by means of a thumb-nut, the return movement of the ratchet C will be prevented by the pawl D, and the spring opposes the return movement of the wheel. In this way no recoil takes place, and the clockwork mechanism continues its movement.

The timing tappets E may be turned into the desired positions relative to the timing dial and be clamped together with the dial to the driven arbor. The plug F of the cock is retained in its seating in a usual way by a plate and a resilient device interposed between the plug and the counterplate. An orifice formed in the plug shell may be normally closed, so as to be gas-tight, by means of packing and a screwed stopper G, and serves for the introduction of some cleaning substance, such as alcohol, for the cleansing of the plug, and, if necessary, of the clearing device with which the burner may be provided.

A supplementary plug cock H allows of the lighting being effected at odd times. The plug is adapted to effect communication between the supply coupling I and the outlet leading to the burner. It is connected to the outlet by obliquely disposed ducts formed in the valve casing. An external handle or key J is connected to the cock for operating it; stops being provided on the plug casing to limit the movement of the handle.

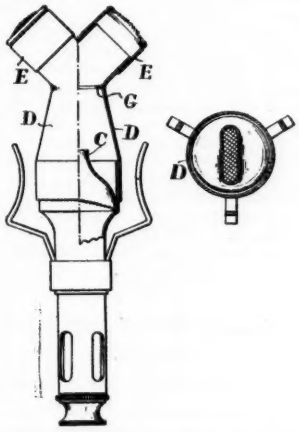
Turning the cock H by hand to open it in no way interferes with the normal operation of the apparatus, and the closure of the plug can be effected after the normal hour for automatic lighting without extinguishing the gas-burner.

Incandescent Gas-Burners.

HERSEY, M. H., of Highbury, N.

No. 24,339; Oct. 20, 1910.

According to this invention, the gaseous mixture passing from a bunsen burner is first compressed in an insertion tube, on issuing from which it is subjected to further compression, "which is not only dependent on the conical shape of the burner head, but also on the preheating of the gas mixture."



Hersey's Upright Incandescent Burner.

The bunsen burner is of the usual construction; and in the head a compressor C is arranged, which tapers to a small opening. A member D is fixed over the head, which is conical and has at its end angular caps E provided with the usual gauze. The cold gas mixture issuing from the bunsen passes with increasing speed through the gradually tapering compressor C and thence to D. The gas is here preheated; the head further acting "as an extra compressor owing to its conical shape." Moreover, the lip G arranged in D "imparts to the flame a shape corresponding to that of the incandescent mantle, and also compresses the gas mixture."

Manufacture of Retorts.

AARTS, J. G., of Dongen, Holland.

No. 23,550; Oct. 11, 1910.

In the modern industry of distilling coal—as carried out in gas-retorts or coke-ovens, whether horizontal, inclined, or vertical—there is, the patentee remarks, an increasing demand for refractory materials which will resist temperatures above 1600° C.—a resistance particularly uncertain in retorts in which the combustion is supported by hot air and more especially when water gas is used, and a resistance not to be trusted under the influence of the flame produced by water gas or coke-oven gas in regenerative retorts or ovens in which the combustion proceeds without excess of air. On the other hand, the mechanical resistance of such refractory retorts and their strength and stability diminish considerably as the temperature rises; while some systems of distillation (particularly those working on a continuous process) demand a very high mechanical resistance. The third condition essential for distillation retorts is tightness or impermeability to gases at high temperatures and at normal pressure. This becomes all the more necessary since at certain periods, and in certain parts of vertical retorts, there is at times very considerable pressure. This tightness becomes a question still more difficult in "those idealized processes of coal distillation" which attempt to prevent partially or wholly dissociation—that is to say, the formation on the walls of carbon, which has hitherto been an "appreciable aid to the tightness of the retort or distillation chamber." This tightness may, he says, be improved by two methods: (*a*) The material may have a high density; (*b*) the structure of the material may present very little porosity.

A fourth quality for an ideal retort would be the property of being able to transmit a very large quantity of heat per unit of surface for a given thickness per unit of time, which is not possible with refractory materials having a basis of clay, silica, or their compounds, as actually used. The thermal conductivity may be increased by three methods: (*a*) The nature of the material; (*b*) little porosity or great density; (*c*) a very high specific weight.

Another condition (of particular importance for vertical gas-retorts or coke-ovens) is indifference to contraction or dilatation at different temperatures varying from 100° to 2000° C.; this condition being especially important in continuous processes of distillation in which in the same retorts there may prevail temperatures varying from 1000° to 1500° C. Such resistance to contraction or dilatation "prevents the cracks and openings which are easily formed when there is the least difference of temperature in existing gas-retorts."

The present invention relates to the manufacture of retorts, whether in one or several sections, or whether built of bricks of the same material, and destined for external heating, such that the retorts satisfy the foregoing conditions. "This fulfilment of the conditions occurs whether the object is merely to distil the coal or to gasify partly or entirely at the same time, or immediately after, in the same chamber, the red-hot residue—that is to say, the coke."

The material which, according to the present invention, serves for satisfying simultaneously the several conditions is silicon carbide in a powdered or crystalline state and mixed for the purpose in view with an agglutinant—preferably clay. Retorts manufactured of this product will, it is said, satisfy the whole of the conditions cited and necessary for ideal coal distillation retorts which are to operate at very high temperatures—constantly or temporarily exceeding 1500° to 1600° C.

(1) Gas-retorts manufactured of the material named easily resist a temperature of 2000° C.; for silicon carbide is refractory at this temperature. It maintains its great stability and primitive strength, and only decomposes above 2200° C.—a temperature at which the silicon begins to volatilize, leaving a skeleton of graphitic carbon. The retort of this material may, therefore, be "subjected without inconvenience to the influence of the most intense flame hitherto industrially known—that is to say, the flame of water gas and even to that of hydrogen and oxygen."

(2) Such a retort will resist at this high temperature the mechanical action of coal and coke, even in retorts in which there is a continuous movement of the charge (whether the retort is horizontal, inclined, or vertical); for "the hardness of silicon carbide is nearly equal to that of a diamond."

(3) A retort manufactured of silicon carbide agglutinated and calcined is impermeable to gases and vapours, (*a*) because of the nature of the material, which vitrifies at the surface as an effect of the high temperature; (*b*) because of the high density and powdered condition of the primary material which carries with it the lowest possible porosity. The retort will, therefore, satisfy the highest industrial demands in relation to tightness.

(4) The thermal conductivity, which is a point essential for distillation of coal and like substances in closed chambers heated externally, is equally improved by this material, (*a*) because careful experiments have shown that the thermal conductivity is about five times greater than that of clay, three times greater than that of cast iron, and that it is only equalled by the conductivity of graphite—a material which, by reason of its great affinity at high temperatures for oxygen, cannot be used for the purpose of distilling coal in retorts; (*b*) because the density is greater, and consequently the porosity is lower.

(5) The resistance to gases and hot acid vapours is perfect for this material; and the distillation of coal very rich in sulphur does not have any influence on the durability of the retort.

(6) The material manufactured as described is indifferent to contraction or dilatation at no matter what temperature and no matter what the variation of temperature, even when very different variations are applied to one and the same retort made in a single piece.

The retorts, sections of retorts, or separate bricks together forming

the retort, may be manufactured in manner similar to that used in making existing refractory materials—that is to say, by mixing the silicon carbide with its agglutinant and moulding the paste for subsequent calcination. But they may also be made in a direct manner—by mixing the carbon with its agglutinant before moulding, and forming the silicon carbide by placing a body containing silicon in a furnace heated to a very high temperature and causing the silicon to evaperate at a temperature above 2200° C. in presence of the moulded graphitic body. The latter, at the high temperature named, absorbs directly the silicon without deformation of the original graphitic skeleton.

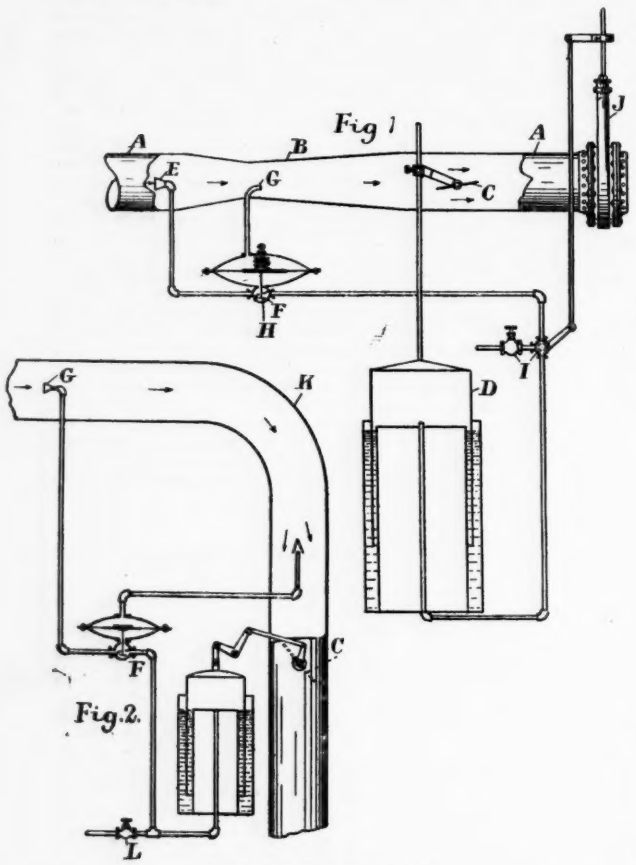
No one has, says the patentee in conclusion, ever applied the whole of the qualities named for the purpose of distilling coal in closed chambers.

Regulating the Flow of Gas or Air.

Cross, F. L., of Madison, U.S.A.

No. 24,754; Oct. 25, 1910.

This invention relates to the automatic regulating of the flow of gas or air through a conduit so that a constant volume is delivered from it. The device is especially adapted for use in the air supply or pressure main of a water-gas plant, and in places where it is desirable to control a comparatively large, slowly moving, air or gas current. The invention is characterized by the subjection of the operating member of an auxiliary control valve of the governor or regulator to the influence of two pressures resulting from the velocities of flow at two different points in the conduit.



Cross's Gas-Flow Regulators.

As shown in fig. 1, A is a main or conduit having a constricted portion or Venturi Tube B inserted in it. A valve C in the main beyond the Venturi Tube is controlled by the float D in a pressure tank, so as to be opened by its rise and closed by its fall. A pipe opening into this float-tank has a funnel-shaped inlet or mouth E turned against the incoming air in the main A in front of the Venturi Tube. A valve F in the connecting pipe has a chamber divided by a movable diaphragm into a lower compartment opening into the valve casing between its intake and valve-seat and an upper compartment which is connected by a pipe whose upper end G lies in the Venturi Tube and is turned away from the current to or beyond the constriction. The diaphragm is connected by a stem to a closure H in the valve which approaches the seat when the diaphragm rises and recedes from it as the diaphragm falls. A spring between the diaphragm and upper part of the casing (regulated by a thumbscrew) affords means for varying its range of action. Between the controlling valve F and the regulator is a relief cock I opening into the air, but operatively connected to a gate J of the main so as to be shut off when the latter is closed. Otherwise it is always open.

In operation, the situation of the oppositely disposed intakes of the pipes from the opposite sides of the diaphragms causes a difference in the pressures on these opposite sides. After adjustment to allow a certain predetermined amount to flow through the main, any fluctuations change the relative pressures initially established on opposite sides of the diaphragm and cause the diaphragm to move one way or the other, thereby increasing or decreasing the pressure in the float and opening or closing the main or conduit valve.

It is found in practice, the patentee points out, that the Venturi Tube effect is produced frequently in gas plants and distributing systems at different places—either by reductions in the main or by turns or elbows therein; and this may be taken advantage of instead of inserting a Venturi Tube in the main. Such an arrangement is shown in fig. 2, where an elbow K or turn in the main replaces the Venturi Tube. In this construction, the controlling valve F, diaphragm chamber, float tank, and main valve C are as described; and the connecting pipe has its inlet or mouth E in the main ahead of the elbow K and turned toward the air current. The pipe from the upper compartment of the diaphragm chamber enters the main beyond the elbow, and has a conical cap or hood in its end which is turned against the current. Then, inasmuch as the main shut-off is not adjacent to the regulator, a relief cock L is placed in the pipe near the pressure tank.

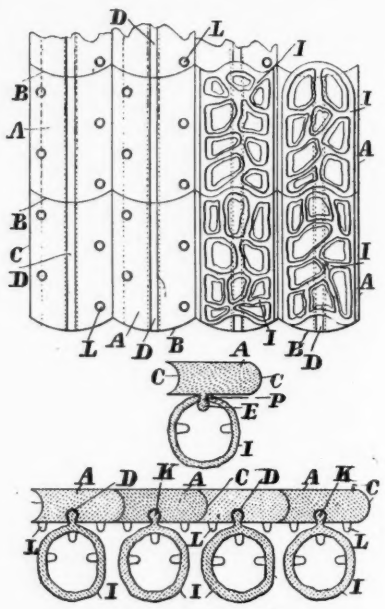
This arrangement shown has the same effect as before—any fluctuations in the current moving the diaphragm through the unbalancing of the pressure thereon, and thus opening or shutting the main valve.

Fuel and Backs for Gas-Stoves.

Barrett, S. R., of Kings Heath, near Birmingham.

No. 27,679; Nov. 28, 1910.

The object of this invention is "to construct the fuel and backs of gas-stoves in short lengths and widths and with the top and bottom edges (and in the case of the backs with the side edges also) shaped so that when either are placed together to form the back or the fuel, each piece becomes locked with its neighbour, and the fuel can be held to the back." Both the fuel and the back can be built up to any height or width and be any shape "without it being necessary to construct either or both in specified sizes and shapes to fit certain stoves as is now the case."



Barrett's Gas-Fire Fuel.

As shown, the fire-clay or other back is made from somewhat small pieces of material A—say, 3 inches in depth by 2 inches in width—each piece being so constructed that it will engage and become locked with its neighbours both at the top and the side. For instance, the ends B and the sides C may be of convex or concave shape, so that the concave portion of one block fits a convex portion of the next block. Then one face of the block may be provided with an under-cut groove D or a projecting rib E along its length (of any desired shape); or the groove or rib along the face of the block may be dispensed with, and a portion F of the concave and convex surfaces C may be cut away to form a groove. Other similar arrangements may be carried out.

The fuel I is made hollow, with the usual openwork or open-worked front and back, or it may be closed either front or back, and in the form of short tubes. The ends may be constructed so that when two tubes are placed end on they, by their shape, will lock together—that is, the ends J may be wavy, or one end may be made concave for fitting with the convex end of the next tube. The back of each tube is provided with a projecting edge or rib K, or with knobs or buttons, of a shape to fit the undercut grooves D, or with grooves P, or projecting ribs or buttons on the back, so that when the fuel is connected to the back the two become locked together. The back may be provided with lugs L to further position the fuel.

Burning a Mixture of Gas and Air in Enclosed Spaces.

Thorp, T., F., & H. T., of Besses o'the Barn, near Manchester.

No. 25,049; Oct. 28, 1910.

This invention, relating to the combustion of a mixture of gas and air in enclosed spaces from which the atmosphere is wholly or partially excluded, consists in supplying a mixture of air under pressure and gas in a predetermined but adjustable proportion to burners and at the same time supplying unmixed air under pressure having a predetermined proportion to the mixture to the flames of the burners, so that

the proportions remain constant irrespective of the volume of gas and air mixture and air passing through the apparatus.

Apparatus has been devised for gas-furnaces and the like, the patentees point out, in which the opening through which air is drawn into the mixing-chamber of atmospheric burners by the gas-jet, and openings through which the air for combustion is admitted to the flames, were regulated simultaneously with the regulation of the gas-jets; but "such apparatus was not adapted for working with air under pressure, and the proportions of air and gas vary with the chimney draught."

The present invention is particularly applicable for the internal heating of calender rollers, but it is also applicable for other heating purposes, such as specially constructed gas-fires, or for keeping incandescent gas-lights burning in closed lanterns, and the like, having only an outlet for the products of combustion.

The internal heating of calender rollers with gas is said to have always presented great difficulties, as the outflow of the products of combustion through the hollow trunnions of the roller excludes the entry of the atmospheric gas required for combustion of the air and gas mixture unless special exhausting apparatus is attached to take away the products of combustion—it being impracticable to introduce the quantity of air required for the complete combustion of the gas into the mixture.

These difficulties are overcome by means of their suggested improved apparatus, which consists of a casing having four chambers or compartments—a gas-inlet chamber, an air-inlet chamber, a mixing-chamber, and an air-outlet chamber. The gas and air are supplied to their respective inlet chambers under constant pressure, regulated in each case by a governor constructed as described in patent No. 22,134 of 1906. Preferably the pressure of the gas is the same as that of the air, but may be higher. From the gas-inlet chamber an outlet opening, provided with a valve, leads into the mixing-chamber. The air-inlet chamber has two outlets and valves; one of the outlets leading into the mixing-chamber, the other into the air-outlet chamber. The sizes of the valve openings into the mixing-chamber are in the proportion of the volume of gas and air to be mixed, and that into the air-outlet chamber is in proportion of the additional volume of air required for combustion to the volume of gas and air mixture supplied through the other valves. The three valves are connected so as to open or close the three outlets simultaneously, and thus maintain these proportions. The gas-outlet, or air-outlet, or both, is arranged so that it can be varied to alter the proportion of gas and air according to their relative inlet pressures and the chemical composition of the gas.

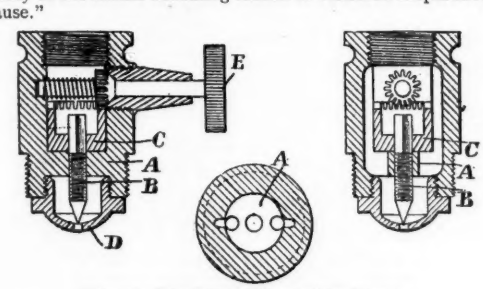
This arrangement of chambers and valves can be constructively embodied in various ways, several of which are illustrated in the specification.

Regulating Nipple for Atmospheric Gas-Burners.

GLOVER, T., of Angel Road, Edmonton.

No. 30,021; Dec. 24, 1910. No. 4901; Feb. 27, 1911.

This combined invention relates to gas-nipples in which the regulating needle is provided with a screw-thread, and is operated in a spiral manner (like a screw) by a toothed ring connected to it and actuated by a pinion positioned at right angles to the ring, with its stem projecting outside the casing—thus obtaining a "more effective action without the possibility of the needle becoming locked or rendered inoperative from any cause."



Glover's Gas-Burner Regulating Nipple.

The interior of the socket piece is provided with a bridge or perforated plate A, in the centre of which is a screw-threaded hole for the regulating needle B. This is screw-threaded for a portion of its length; the other part being shaped to receive a cup-piece C situated on the opposite side of the bridge A to the nozzle D. It is provided with a central hole at the bottom corresponding to the shaped portion of the regulating needle which it engages and with teeth on its upper edge. The teeth engage with a pinion on the stem of the turn button E, which has a bearing in the usual gland or stuffing box which projects at right angles to the main or socket piece. The end of the stem finds a bearing in a recess in the side of the main socket piece opposite to the gland, a spring being interposed on the stem (between the inside of the main socket piece and the pinion) to press the pinion against the end of the stuffing-box and further assist in preventing any escape of gas at his part by forming a surface contact.

The point of the needle is positioned to have action in a hole in the nozzle-piece D as usual; but, instead of the needle being pointed, it may have its end formed ball or dome shaped for having action against a curved seating projecting inside the nozzle.

By turning the thumb button E, the pinion revolves the cup-piece C, and this revolves the regulating needle B in the bridge A; and the connection of the needle with the bridge being by screw, the needle will be moved to and from the hole in the nozzle D to regulate the outflow of gas, while the shaped portion of the needle will move up and down in the cup-shaped piece C.

The Davis Gas-Stove Company, Limited, have made very large extensions to various departments of their works; and we understand that, with the further extension of their moulding shop, they have the largest shop of this kind under one roof in the country. We are informed that, owing to the large demand for their heating-stoves, their works are being carried on night and day.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Electrical Cooking and Water Heating Claims.

SIR,—We are sending you herewith a copy of the "Builder" for Sept. 22, and also for Nov. 3, in order to draw your attention to Mr. Harold Gray's article on "Electric Cooking Apparatus" on p. 334, Sept. 22 issue, as well as our reply, which appears on p. 509 of the issue for Nov. 3.

This is an important matter from a gas company's point of view; and we send the original reference and the reply to deal with as you may desire.

THE DAVIS GAS-STOVE COMPANY, LIMITED.
CYRIL G. DAVIS, Managing-Director.

59, *Queen Victoria Street, E.C., Nov.* 7, 1911.

[The enclosures are reproduced in our "Miscellaneous News" columns to-day, p. 481; and allusion is also made to the subject in paragraphs following our leading articles this week.]

Compensation Arbitration at Newton Abbot.

The Newton Abbot Gas Company were last Friday the respondents in an arbitration case heard before his Honour Judge Lush Wilson, at Newton Abbot County Court. The plaintiff was Mrs. Alice Mary Caunter, widow of Chas. A. Caunter. Mr. Hutchings, for the widow, said the deceased was in the employ of the Company; and on July 22 he was fixing up pipes and lamps and doing plumbing work for some local celebrations. He was engaged away from the works; and at 7 o'clock in the morning he was seized with sunstroke or heatstroke, and died four or five days afterwards. The aggregate of his wages for three years was £216 9s., and the only dependant was the applicant. Deceased was working twelve hours a day from the Monday to the Thursday; and on the Friday (the day before he was seized) he was working in an almost tropical sun from 6 o'clock in the morning till 8.30 in the evening, in order that the job might be completed by the Saturday. Evidence was given in support of the contention that the man was in good health up to the time of the seizure; but his Honour said he should like medical evidence. Mr. Almy, for the Company, submitted that the plaintiff had failed to prove that the accident arose out of, or in the course of, the man's employment, or by unusual or abnormal work. The Court Bailiff stated that he had always known deceased as a steady, hard-working, sober man. His Honour said it was a serious question; but he had arrived at the conclusion that the case had not been made out as coming within the Compensation Act. Having regard to the early hour of the morning, and the very light nature of the duty, it would be straining the law beyond all reason if he held that plaintiff had shown to his satisfaction that the deceased man met with his injury while being subject, by reason of his employment, to more than ordinary risk. Mr. Almy remarked that the Company did not ask for costs.

Damages for Gas Poisoning in Glasgow.

The trial took place before Lord Ormidale and a Jury, in the Court of Session in Edinburgh last week, of an action by James Maher, residing in Bleahein Street, Springburn, Glasgow, against the Corporation of Glasgow. Pursuer sued for £500 damages for injuries said to have been sustained by himself and his son William, 7 years of age, through their having been poisoned by an escape of gas. It was averred that a prepayment gas-meter and fittings, which were the property of defenders, were not kept by them in a proper and safe condition of repair. The defenders denied this, and pleaded contributory negligence; maintaining that if there was at any time an escape of gas into the pursuer's house, it was the duty of the pursuer to notify the defenders of the escape, and, if necessary, to leave the house until the escape had been remedied, This, it was averred, was not done. The gas poisoning incident was said to have occurred on Feb. 3, 1910; and it was not until Feb. 7 that the defenders received complaint of an escape of gas. The Jury gave their verdict for the pursuer, and awarded £50 to both him and his son.

A Defective Prepayment Meter.

At the Colwyn Bay County Court, John Conway, a working man, was sued by the Colwyn Bay Urban District Council for the recovery of 11s. 5d., the difference between the money found in his prepayment meter and the price of the quantity of gas which the meter registered as having been used. On behalf of the Council, Mr. Osborn said defendant had signed an agreement to pay for the gas consumed. The inspector discovered that the automatic arrangement would only work until 18 cubic feet of gas had passed, and it would then stick, allowing the gas to go through, instead of shutting it off when the proper quantity had gone through. It would start again when another penny was put in. There was only 4s. 1d. in the apparatus, though 15s. 3d. worth of gas had been supplied. His Honour Judge Moss said it would be very hard on the consumer, who thought he was paying for his gas as he used it. The defendant said he knew nothing about the mechanism; but when the meter appeared to want a penny he put one in. Other houses in the neighbourhood used about the same quantity of gas; and he imagined there was nothing unusual in the amount he had put in. Nobody had tampered with the meter in any way. The alleged agreement was produced; and his Honour held that it was no agreement at all. There was, he said, not even a price named at which the gas would be supplied. The defendant said he had not signed the document produced, which was a request to the Council for a supply of gas through a slot-meter; and the case was adjourned, so that the official who took the signature might be called. Defendant's costs of the day, his Honour said, must be paid by the Council.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary Meeting of the Association was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. J. HORSLEY PALMER in the chair.

The SECRETARY (Mr. R. W. Wilson) read the notice convening the meeting; and the report of the Directors and the balance-sheet were taken as read.

PROFIT AND RESERVE FUND.

The CHAIRMAN: It is now my duty to move—"That the report and accounts be adopted and entered on the minutes." With such a voluminous Directors' report before you, which enters into so many details in a rather uneventful half year, there is very little left for the Chairman to say. I should, however, like to try to interest you for a few minutes in some of the matters with which we have been occupied during the half year, and in regard to some of the clauses of the report. Naturally, the clause of the report of most interest to the proprietors is that which relates to the profit. The profit made, as you will see, is £281,767, being £12,617 more than was made in the corresponding half year of 1910. But I must point out that, in that corresponding half year, the accounts bore the charge for income-tax upon the amount distributed as dividend, while now no charge appears upon that account. As this accounts for a difference in favour of the results of the past six months of £12,967, it will be apparent that the actual working profit corresponds very closely with that of the corresponding half year. The proposal the Directors make to you is that the amount available for distribution, £308,045—that is to say, the profit *plus* what we brought forward, £26,278—shall be divided as follows: The payment of a 4½ per cent. dividend, which will take £222,300, of the allocation of £40,000 to the pension reserve, and carrying forward £45,745. If this scheme be adopted, as I sincerely hope it will be, we shall carry forward to the current half-year's accounts a rather larger sum than usual—as I have said, £45,745. But in view of certain contingencies to which I shall refer, I do not think this is an excessive amount. Then, to take the next paragraph in the report dealing with the reserve fund. The position of this is that at the present time we have £474,000 nominal of Consols—2½ per cent. consolidated stock—standing at the value in our books of £400,000, which means we have written it down, or rather by adding Consols have brought the average price down to 84·38. We propose to continue during the present half year what we have done in the past, by adding to the reserve fund £26,000 nominal of Consols; and this will bring the total amount of Consols held as a reserve to £500,000, representing a cash value at 80 of £400,000, which was the sum put aside in the old days for a reserve fund. Of course, we all know that Consols have gone down to below 80; and it will be a matter for future consideration as to whether we shall still further write them down.

PROGRESS OF THE GAS BUSINESS.

With regard to the progress of the business, the Directors are perfectly satisfied with it. The increase in the consumption of gas is upwards of 6½ per cent.; and the number of consumers has advanced at the rate of 7¾ per cent. I believe, had it not been for the extreme mildness of the winter in Berlin and generally on the Continent, that the increase would have been very much more. It is rather interesting to note the growing consumption of gas for purposes other than lighting. With respect to the supply of gas for lighting, we have no doubt a very formidable competitor in the electric light; and, under the circumstances, we can be well satisfied with the fact that the increase of the consumption for lighting purposes only is 3 per cent. But we have done well in the domain of heating and other domestic purposes. Figures that have been given to me by the Secretary show that the consumption of gas during the hours of daylight progressed at the rate of about 8 per cent. Then the prepayment meter system of gas supply has gone ahead very much on the Continent. It has had a considerable influence on the use of gas during daylight hours. Of the 145,000 prepayment meters mentioned in the report, 6500 were connected during the half year—that is to say, half the new consumers were of the prepayment class. The amount of gas consumed by the prepayment consumers was about 622 million cubic feet, representing more than 11 per cent. of the total sale of gas to private consumers.

RESIDUALS—DROUGHT AND COKE CONSUMPTION.

To refer to the residual products, which are, of course, an important factor in the business, I come to rather a sorry account as regards coke. We carbonized last half year 27,000 tons more coal, and, of course, we had a large amount of coke of which to dispose. Unfortunately, we had to encounter two consecutive mild winters throughout Germany; and the stocks at the stations naturally increased very largely. I believe, at the end of the half year to June 30 last, we had no less than 67,000 tons of coke at the different stations; while on June 30, 1909, we had only 30,169 tons. We certainly had a cold snap in March, which disposed of a certain amount of coke; but it lasted so short a time that it really did not reduce our stocks very much. But I am glad to be able to report that since June 30 there has been an immense demand for coke in the North of Germany, owing to a very peculiar reason. You know we have suffered in England from great drought; and the drought in Germany has been even more intense than in England. The result was that the great water-ways of Germany were depleted; and the progress of the transit of coal and coke from Hamburg, Bremen, and Stettin was almost stopped. The result was that the importation of coke from Hamburg into Berlin and the other big towns in North Germany was 61,000 tons less than in the summer of 1910. Knowing this, and anticipating a cold winter, the merchants rushed in, and bought large amounts of our coke. The result is that, though we have had to part with our stocks at somewhat low prices, compared with the previous year, when we visited the stations in North Germany only a few weeks ago, the stocks had been very greatly reduced.

EARLY MISFORTUNES OF A GASHOLDER.

A year ago, I mentioned to you the fact that we had built at Schöneberg, one of our Berlin stations, a large gasholder; but I am very sorry to say this holder has had a somewhat unfortunate history. In the course of its construction, an accident happened to the contractors' crane. This had nothing at all to do with the Imperial Continental Gas Association; we were not liable in any way. But the crane fell across a train which was passing our works on the Government lines, and there was considerable excitement on the subject. The result was the completion of the holder was considerably delayed. In

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 441.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 12	5	Alliance & Dublin Ord.	79—82	..	6 1 11
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	5	Sept. 28	7	Bombay, Ltd.	6—6¾	..	5 7 8
50,000	10	Aug. 31	15	Bourne- 10 p.c.	28½—29½	..	5 1 8
311,810	10	"	7	mouth Gas B 7 p.c.	16½—16¾	..	4 3 7
75,000	10	"	6	and Water Pref. 6 p.c.	14½—14¾	..	4 1 4
380,000	Stk.	Aug 16	13	Brentford Consolidated	256—261	..	4 19 7
330,000	"	"	10	Do. New	198—203	..	4 18 6
50,000	"	"	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	"	June 15	4	Do. 4 p.c. Deb.	98—100	..	4 0 0
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	217—222	..	4 19 1
246,320	"	"	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Sept. 28	12½	British	44½—45½	..	5 9 11
120,000	Stk.	June 30	4	Do. 4 p.c. Deb. Stk.	94—96	..	4 3 4
109,000	"	Aug. 16	6	Bromley, A 5 p.c.	117—122	..	4 18 4
165,700	"	"	4½	Do. B 3½ p.c.	90—92	..	4 17 10
82,278	"	"	5½	Do. C 5 p.c.	105—110	..	5 0 0
55,000	"	June 30	3½	Do. 3½ p.c. Deb.	82—84	..	4 3 4
250,000	Stk.	"	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4¼—5¼	+¼	—
100,000	Stk.	June 30	4½	Do. 4½ p.c. Deb. Stk.	80—83	..	5 8 5
157,150	Stk.	Aug. 16	5	Chester 5 p.c. Ord.	109—111	+2	4 10 1
1,513,280	Stk.	"	5/9/4	Commercial 4 p.c. Stk.	110—112	..	4 17 7
560,000	"	"	5½	Do. 3½ p.c. do.	105—107	..	4 19 8
475,000	"	June 15	3	Do. 3 p.c. Deb. Stk.	76—78	..	3 16 11
800,000	Stk.	May 31	4	Continental Union, Ltd.	90—95	..	4 4 3
200,000	"	"	7	Do. 7 p.c. Pref.	135—137	..	5 2 2
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	"	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	July 28	10	European, Ltd.	19½—20½	+½	4 18 9
16,16[illegible],600	Stk.	Aug. 16	4/14/8	Gas- 4 p.c. Ord.	104½—105½	..	4 9 9
2,600,000	"	"	3½	light 3½ p.c. max.	84½—86½	..	4 0 11
4,062,235	"	"	4	and 4 p.c. Con. Pref.	102—104	..	3 16 11
4,531,705	"	June 15	3	Coke 3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept. 14	5	Hastings & St. L. 3½ p.c.	94—96	..	5 4 2
82,500	"	"	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	17—17½	..	6 5 9
131,000	Stk.	Sept. 14	7½	Ilford A and C	154—157	+2	4 15 6
65,780	"	"	6	Do. B	125—128	+2	4 13 9
65,500	"	June 30	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
4,940,000	Stk.	Nov. 10	9	Imperial Continental	183—185*	+2	4 17 3
1,235,000	Stk.	Aug. 16	3½	Do. 3½ p.c. Deb. Red.	90—92	..	3 16 1
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	125—130	..	4 12 4
561,000	Stk.	Aug. 16	10	Liverpool United A.	218—220	+1	4 10 11
718,100	"	"	7	Do. B.	164—166	..	4 4 4
306,083	"	June 30	4	Do. Deb. Stk.	102—104	..	3 16 11
75,000	5	June 15	6	Malta & Mediterranean	4⅞—5⅛	..	5 17 1
560,000	100	Oct. 2	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	"	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 10	3½	Monte Video, Ltd.	12¼—12⅝	..	5 9 10
1,775,892	Stk.	July 28	4½	Newc'tle&G'tesh'd Con.	101—102	−1	4 5 9
529,705	Stk.	June 30	3½	Do. 3½ p.c. Deb.	87—89	..	3 18 8
55,940	10	Aug. 31	7/7/0	North Middlesex 7 p.c.	14½—15½	..	4 14 10
300,000	Stk.	Apl. 27	8	Oriental, Ltd.	138—140	..	5 14 4
60,000	5	Sept. 28	8	Ottoman, Ltd.	6½—7	..	5 14 4
31,800	53	Aug. 16	18	Portsea Island A	140—145	..	4 14 10
60,000	50	"	13	Do. B	133—138	..	4 14 2
100,000	50	"	12	Do. C	130—135	..	4 8 11
398,490	5	Oct. 12	8	Primitiva Ord.	7⅞—7⅞	..	5 4 11
796,980	5	June 30	5	Do. 5 p.c. Pref.	5⅛—5⅜	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	June 30	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
250,000	5	Sept. 28	12	San Paulo, Ltd.	10½—10⅝	−¼	5 11 7
115,000	10	"	6	Do. 6 p.c. Pref.	11½—12	−⅛	5 0 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Aug. 31	10	Sheffield A	238—240	..	4 3 4
209,984	"	"	10	Do. B	238—240	..	4 3 4
523,500	"	"	10	Do. C	238—240	..	4 3 4
90,000	10	Sept. 28	6	South African	8—9	..	6 13 4
6,429,895	Stk.	Aug. 16	5/9/4	South Met., 4 p.c. Ord.	116—118	..	4 12 8
1,895,445	"	July 14	3	Do. 3 p.c. Deb.	79—81	..	3 14 1
209,820	Stk.	Aug. 16	8½	South Shields Con. Stk.	155—157	+1	5 8 3
605,000	Stk.	"	5⅝	S'th Suburb'n Ord. 5 p.c.	119—121	..	4 13 6
60,000	"	"	5	Do. 5 p.c. Pref.	115½—117½	..	4 5 1
117,058	"	July 14	5	Do. 5 p.c. Deb. Stk.	121—123	..	4 1 4
502,310	Stk.	Nov. 10	5	Southampton Ord.	106—108*	+½	4 12 7
120,000	Stk.	Aug. 16	7½	Tottenham A 5 p.c.	145—148	..	4 16 3
483,940	"	"	5⅝	and B 3½ p.c.	115—117	..	4 16 1
149,470	"	June 15	4	Edmonton 4 p.c. Deb.	96—98	..	4 1 8
182,380	10	June 15	8	Tuscan, Ltd.	8⅜—9¼	..	8 13 0
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96—98	..	5 2 0
236,476	Stk.	Aug. 16	5	Tynemouth, 5 p.c. max.	113—115	..	4 6 11
255,636	Stk.	Aug. 31	6⅞	Wands- B 3½ p.c.	142—145	..	4 14 10
85,766	"	June 30	3	worth 3 p.c. Deb. Stk.	71—73	..	4 2 2

Prices marked * are "Ex. div."

Germany, before a structure can be erected, one has to apply for a concession; and that concession only gives a definite period in which to finish the work. Owing to these various delays, the contractors were unable to complete the work within the prescribed time; and when the holder was finished, and we wished to make use of it, the communal authorities stepped in, and served us with an injunction to prevent us doing so. The result is that up to the present time, this holder, which has cost us something like £58,000, is not earning a single penny. We have lodged an appeal, which, we hope, will be successful.

RAILWAY STRIKES AND COAL SUPPLY.

The proprietors may well believe that during the past half year, what with strikes on railways and in various other directions, the Directors have had a great deal of trouble and anxiety with regard to coal. We are now carbonizing well over a million tons of coal a year; and of this something like 450,000 tons go from England. We ship it to Berlin, to Antwerp, to Brussels, and some of it gets as far as our small and most inland stations. The English coal for the Berlin station is shipped on the Tyne, taken to Hamburg or Stettin, put into lighters there, and transported by water to Berlin. As I explained to you just now, owing to the drought (which has been more severe in Germany than over here), the water-ways became so short of water that very serious delays have been experienced in getting the coal up to Berlin. However, I am very thankful to say that, when the Directors were in that city a fortnight ago, owing to the energetic measures taken by the Secretary and our local officers, we had a splendid stock of coal, which I think will tide us well over all our winter requirements. It has been, of course, a very serious position; but I do not think that we need be very anxious about it now.

THE VIENNA LIQUIDATION.

At the last meeting, I had to speak very briefly on the subject of the Vienna liquidation. Since that period, I have, in connection with this matter, noticed various reports and letters in the financial papers more or less correct; and I think it would be well for the proprietors to have the true facts of the case now put before them. I stated in very general terms last time that satisfactory arrangements had been made with the Corporation with regard to the liquidation of the business. Under the existing contract, it was stipulated that the town should purchase the mains, lanterns, services, meters—in fact, all plant outside the works, and the price was mutually agreed upon. The town of Vienna have also purchased the outside plant in Floridsdorf, and certain other communes where the Association's contracts had some years to run, and have compensated the Association for the loss of profits in these districts. The Municipality and the Association have quite recently come to a satisfactory arrangement, under which the Corporation have acquired the site of two of the disused gas-works—Baumgarten and Währing—and the site of the Association's head office on the Schenkenstrasse. We have also sold the whole of the old buildings and useless plant on the gas-works to a contractor, who, at the close of the year, when our concession terminates, will demolish the whole, and clear it away. In addition, the Association will have a considerable amount of land of which to dispose; and the Directors think there will be no great difficulty in selling at satisfactory prices. That is exactly the position at Vienna at the present moment; but in the future we have to face these two things: The fact that we are losing a profitable station; and the further liability that is imposed upon us by the fact that certainly for some years after the cessation of business there, we shall require a total annual expenditure of something like £20,000 for pensions and allowances to the engineers, staff, and workmen at the station.

A PROMISING OUTLOOK.

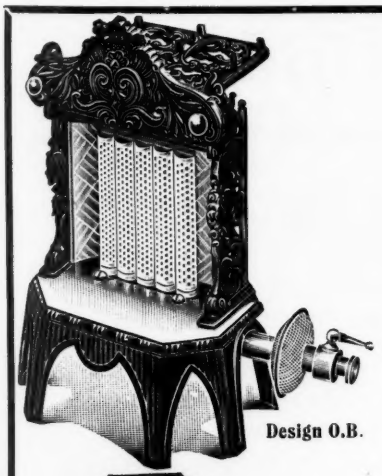
This, gentlemen, is what I have principally to tell you to-day. Your Directors have been most assiduous, as they always are, in attending to the interests of the proprietors on the Continent. During the whole of October, there were seven Directors travelling in all directions examining the stations, seeing that they are kept in proper order; and I believe they have all come home perfectly satisfied that the interests of the proprietors are safely guarded, and that we have a very promising outlook for the coming winter.

The DEPUTY-CHAIRMAN (Mr. Arthur Lucas) seconded the motion.

Mr. A. E. FLOWERS asked whether some of the employees at Vienna could not be transferred to other stations, and thus avoid paying part of these pensions, upon which there was no return.

Mr. F. H. NORMAN inquired whether the Association had power to supply electricity.

The CHAIRMAN replied that, of course, the Board tried to find places for as many of the employees as possible. They had been endeavouring to make arrangements with the Municipality to take over the men who were under a certain age. They had also transferred one of the engineers to Berlin. But, of course, there were always in undertakings of this sort—where they had been in operation for a great number of years—a certain number of old men whom nobody would take over; and the Association were bound, by their regulations, to provide them with pensions. With regard to Mr. Norman's question, the Association had electricity rights under many of their concessions. They had very important electricity works at Brussels and other places; and he would notice, in the balance-sheet, that they had invested, in foreign gas and electricity companies, a very large sum of money. The Directors had interested themselves in electrical matters especially in towns which the Association lighted with gas, because they thought it to the interest of proprietors that harmony should prevail between electrical and gas companies, instead of being perpetually fighting one against the other. He should explain with reference to the £20,000 in pensions at Vienna that about £10,000 of this represented pensions which they were already paying. It was a heritage from the relinquishing of the town part of Vienna. The other £10,000 would have to go to the employees who were retained for the working of the suburbs.



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The motion was unanimously adopted.

Proposed by the CHAIRMAN, and seconded by the DEPUTY-CHAIRMAN, a dividend of 4½ per cent. (less income-tax) for the half year was declared upon the £4,940,000 stock of the Association.

Mr. NORMAN proposed a vote of thanks to the Chairman and the Board. In doing so, he thanked the Chairman for the answer he had given to his question; but he must point out that it did not fully explain what he wanted to know. The investment of £1,400,000 in gas and electrical undertakings did not answer his question as to whether or not the Association were engaged to any large extent in generating and supplying electricity. He should like to know whether this was a fact, and whether it was a satisfactory business.

Mr. H. S. CROFT seconded the motion, which was cordially agreed to.

The CHAIRMAN, in acknowledging the vote on behalf of himself and his colleagues, said the Association had electrical works of their own at Brussels and at Komotau, in Bohemia. They had a large interest—almost a controlling interest—in the electrical works at Lille; and there were several other small stations. This would give some idea of the scope of the business in electricity. They generally made a manufacturing profit on the electricity generated. Before sitting down, he should like to move a vote of thanks to all the officers both at home and abroad. From the personal knowledge of the Directors, they were devoted to the service of the Association, and always worked with great zeal in promoting its interests. He need hardly mention that there could be no abler Secretary than Mr. Wilson, who had devoted his whole life to the Association.

Mr. J. H. BIRCHENOUGH, C.M.G., seconded the motion, which was heartily passed.

Mr. WILSON, in the name of the officers at home and abroad, thanked the proprietors.

COLONIAL GAS ASSOCIATION, LIMITED.

An Increased Dividend—Thirteen Per Cent. Increased Sales.

The Ordinary General Meeting of the Association was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. SAMUEL SPENCER in the chair.

The SECRETARY (Mr. Alfred J. Kingdon) read the notice convening the meeting and the Auditor's report; and the report of the Directors and the statement of accounts were taken as read.

The CHAIRMAN, in moving their adoption, said it was with much pleasure that the Directors met the shareholders again, as it was their hope last year that they would have a very good balance-sheet to present on this occasion; and they were much gratified that the results had enabled them to increase the dividends to 6 per cent. per annum, free of income-tax—an amount that they had been anxious to pay for several years past. This satisfactory start towards a better dividend in future encouraged the Directors to think that from now the shares would command par, or a higher price than had been experienced for many years past. It would also enable them from now to issue ordinary shares at par, or at a small premium—a position they had been hoping to be in for several years past. He was glad to say that during the past month a small number of shares were on offer; and he could not purchase them at par. He had again the pleasure of saying that the Company were doing better than for many years past; and the shareholders might rest assured the Board had not increased the dividend this year without feeling sure that it could be maintained, and with the prospect of soon increasing it; for, as most of the shareholders, if not all, knew, Australia was now enjoying a greater prosperity. With such a satisfactory statement as this, the Directors had the greater personal regret (which he was sure would be participated in by the shareholders) in announcing that the Hon. George Swinburne, their Managing-Director for so many years, and who had been with them from the installation of the Association—had been advised by his Doctor that he must lessen his work. Therefore, in response to a cable, the Board had accepted his resignation. Mr. Swinburne, he was pleased to say, would continue to act as their Adviser and Attorney, which was a position coming within the Articles of Association for the good working of the Local Board in Australia. This change had naturally brought about two or three new appointments; and the Directors wished to say that they felt confident the affairs of the Association would continue to be well looked after. It was with much satisfaction that the Board had to report that they had had the pleasure during the past six months of having Mr. Andrews, their Melbourne Director, on a visit to England, and that he had attended their meetings. It was with much regret on his part, and that of the Board, that he could not remain for the annual meeting. Mr. Andrews had assured them that they had a thoroughly sound and good business, and that it was being well looked after in Australia. Since the last meeting, the Association had duly received the agreed payment for the Geraldton works, with management expenses and interest up to the date arranged. Of course, the sum received did not give them the same amount in return as the profits made from the works; and it was necessary to look after another works. Their late Managing-Director succeeded, as mentioned in the report, in securing a concession for the lighting of Casino. The works were started a few weeks ago; and the Board were full of hope that they would turn out as well as those they had sold. Turning to the balance-sheet, he said it was gratifying to announce that the increased sale of gas amounted to 13 per cent. for the year ending June last—2 per cent. more than the increase in the previous twelve months—and the returns for the past quarter were much better. This was most satisfactory; but it meant the raising of more capital in the very near future. This the Board would cheerfully advise the shareholders to do, as they would, he was certain, with 6 per cent. dividends, free of income-tax, be able to readily raise the amount wanted for the necessary expenditure. The money would be required for a new holder, purifiers, scrubbers, &c.; and in regard to this out-

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lay, he was very pleased to say that Mr. Swinburne hoped to be in England early in the new year, and would give the Board the benefit of his advice as to what was needed. The capital account, it would have been noticed, was increased by £5400 of debentures, in order to complete the payments in connection with the newly installed Casino works, and to meet the other extensions to mains and plant. These outlays amounted in all, for the past year to £14,587—£9112 for the Casino works, and £5475 for plant and mains. The reserve fund, it would be noticed, had been increased by £809; making the satisfactory amount of £7078 to the credit of the fund. Of this, £2687 was invested outside the Company; and as the profits of the Association increased, he should like to see a further sum added from time to time. Up to now, it had been necessary to keep most of the reserve fund in the business, as they had been short of working capital; and, of course, they could not issue further ordinary shares, as they could not be issued at their par value. But the condition of the Association being so much improved, he considered they should have no difficulty in placing further shares; and he hoped it would be done at an early date. He might mention that their investments returned good dividends, and the capital value of them had increased. Here he might say that they would not for a moment think of putting money in such funds as were called trustee securities—Consols in particular—in which most of the English companies had invested their funds, and were now constantly year by year writing them down, from (say) 95 to 108 as purchased to as low as 75 to 80. Their revenue account showed that coal had cost less than in the previous year. Residuals had not given quite so much; but this arose from the abnormal prices obtained for coke the preceding year. Receipts from the sales of gas were only some £400 more; this being due to the reduction in prices per 1000 cubic feet that they had made at the various works. The stocks were about the same as last year. In conclusion, he desired to say that the prospects of the coming year appeared as favourable as they could wish.

Mr. W. C. PARKINSON seconded the motion, remarking that they all rejoiced at the continued prosperity of the Company, which was advancing in every quarter.

The motion was unanimously adopted.

Proposed by the CHAIRMAN, and seconded by Mr. CHARLES HUNT, a dividend was declared of 4 per cent., making, with the interim payment of 2 per cent., 6 per cent. for the year, free of income-tax. The resolution also included the addition of £500 to the reserve fund.

The CHAIRMAN proposed the re-election as Directors of Mr. Charles Hunt and Mr. F. R. Smith. In Mr. Hunt, he remarked, they had a member on the Board who was second to none in England in his experience and knowledge of gas matters; and, as to Mr. Smith, since he had been on the Board, he had given them the greatest possible advantage and satisfaction.

Mr. W. H. RICHARDSON seconded the motion, which was heartily agreed to.

Mr. HUNT, in acknowledgment, said he need hardly assure the shareholders that he was very anxious for the welfare of the Association; and he was pleased indeed the efforts of the Board had been so far successful. The Directors had been hoping for a long time past to work the dividend up to 6 per cent. This was a very respectable dividend, and one which they might be satisfied they could earn. He believed the time would come when they would earn more; but he hoped the shareholders would not be too anxious for an increase beyond this. The efforts of the Board were directed to consolidating the Association, and improving the finances. This was the first consideration that should weigh with a Board of Directors; the next was to give shareholders as much dividend as could be properly declared.

Mr. SMITH remarked that it was an honour to sit on the Board, because all the members had been connected with gas affairs all their lives; and he thought the success of the Association had been largely due in the past to the efforts of the Directors in very carefully looking after the affairs.

The Auditors (Messrs. Wood, Drew, and Co.) having been reappointed,

Mr. RICHARDSON expressed the appreciation of the shareholders with the successful services of the Chairman and Directors.

Mr. F. R. SMITH said he was sure the shareholders would not care to separate without also placing on record their appreciation of the services of the Hon. George Swinburne, and an expression of regret that ill-health was the cause of his resignation. They were, however, pleased to know that Mr. Swinburne was going to continue as the Association's Adviser and Attorney. He (Mr. Smith) would like to move a very hearty vote of thanks to Mr. Swinburne and to the staff in Australia.

Mr. RICHARDSON seconded the motion, Mr. SAMUEL WHILE supported it, and it was cordially adopted.

This concluded the proceedings.

Preventing Waste of Coal.—Writing to the "The Times" on the subject of Sir William Ramsay's letter to that paper reproduced in the "JOURNAL" last week (p. 405), "L. J." says: "It may be of interest to recall the very strong expression of opinion made on preventing waste of coal by the Royal Commission on Coal Supplies, which may have escaped attention because it is contained, not in their final, but in their second report, dated Feb. 24, 1904. After explaining that the witnesses examined between January and October, 1903, dealt principally with possible economies and improvements in connection with the working, preparation, transport, and use of coal, and with the possibility of substituting other kinds of fuel and of adopting power derived from other sources, they go on to say: 'We are not yet in a position to make recommendations upon the information received; but the great possibilities of economy indicated by the witnesses, affecting as they do every class and every trade, make it of the utmost importance that the evidence should be carefully studied, not only in the interests of individuals, but in the interests of the nation as a whole.'"

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should always be assembled with

MALLEABLE PUSH-NIPPLES

Any other joint is unsatisfactory.

STEEL PUSH-NIPPLES

are proved by experience to corrode in a

FEW YEARS.

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THE "ST. ANDREW"
GAS-HEATED
STEAM RADIATOR
is assembled with
MALLEABLE PUSH-NIPPLES
making a perfect metal-to-metal joint.

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FATAL EXPLOSION IN GLASGOW.

Erroneously Attributed to Gas.

Last Friday night, an explosion occurred in the flour-mills of Messrs. William Primrose and Sons, Limited, in Centre Street, Glasgow, by which a five-storey building was wrecked, a man and a boy were killed, injuries were sustained by six other men, and four children, who were opposite the building at the time of the occurrence, were supposed to be buried in the *débris*. It was at first reported in the Glasgow papers that the explosion was due to an escape of gas; but on special inquiries being made by the Corporation Gas Engineer (Mr. Alexander Wilson), he could not learn anything to justify the accident being attributed to this cause. The "Glasgow Herald" on Saturday, in recording the disaster, said: "The cause has not yet been ascertained, and various theories have been advanced. It was at first believed that the explosion was due to gas. There was no gas plant, however, in the part of the premises in which the explosion occurred; but the departments were fitted with several gas-jets. The testimony of several workers was to the effect that there was no smell of gas before the explosion occurred. Mainly on account of this fact, and of the circumstance that the fall of *débris* was largely in one direction, the theory of gas being the cause has been dismissed; and it is conjectured by those qualified to judge that the origin of the accident has been due to dust. It is presumed that the explosive force was generated by vibration; but what the exact scientific explanation of the disaster may be cannot yet be stated."

HUDDERSFIELD GAS AND WATER SUPPLY.

In the course of the address by the Mayor of Huddersfield (Mr. George Thomson), at the close of his year of office, he made the following remarks on the gas and water undertakings of the Corporation.

The output of gas during the year ending March, 1911, amounted to 848 million cubic feet—an increase of 69 millions over the previous year, equal to 9 per cent., which constituted not only a record, but showed the largest annual increase ever obtained. This increase has not been confined to one class of consumers, but has been made up as follows: Seven million cubic feet more gas has been used for lighting purposes; 29 million cubic feet more for engines, cooking, and power purposes; and 33 million cubic feet more for prepayment meters. The income for the year was £102,265, and the expenditure £79,864; leaving a gross or trading profit of £22,401, equal to nearly 7 per cent. on the capital of £322,655. The profit was allocated as follows:—

Interest on loans, &c.	£11,919
Sinking fund	1,795
Depreciation and contingencies fund	2,845
To relief of rates (3d. in the pound)	5,842

The total contributions by the Gas Department towards the relief of local taxation amounts to £161,227, which, accumulated at interest, would, including the sinking fund, have paid off the capital of the undertaking. Since the year 1897, no addition has been made to the capital. The amount paid for borough, district, and poor rates for the year 1911 was £6960. The contingencies fund in hand now amounts to £35,609, and the accumulated loans towards the redemption of the capital account to £105,610—showing the actual indebtedness of the department to be £183,781. The total number of gas consumers is now 30,298—an increase of 648 on the year.

With respect to the water undertaking, the impounding reservoirs and also the service reservoirs have been well maintained. At the Deerhill reservoir the filter-beds work satisfactorily; and the extension of the catchwater to the bywash of the Wessenden Head reservoir is completed. Water is being drawn from the Butterley and Blakeley reservoirs for town purposes into the Longwood reservoirs, after filtering through six Bells filters. The water from the Wessenden Head reservoir is used for supplying the high-level districts, and is drawn through the Scapegoat Hill service reservoir. The quantity of water in store at the Blackmoorfoot reservoir is 220 million gallons, compared with 417 million gallons at this time last year. The renewal of mains during the year was 1033 yards, compared with 3312 yards before; and the extension of mains 9630 yards, compared with 5782 yards. The total length of mains is about 317 miles 1611 yards. The number of gallons of water supplied through meters last year was: Inside the borough, 537,891,000 gallons; outside, 117,724,000 gallons—total, 655,615,000 gallons, compared with 586,659,000 gallons last year; showing an increase for trade purposes of 68,956,000 gallons. The population supplied is: Inside the borough, 108,446; outside, 45,163—total, 153,609, compared with 156,127 before. The apparent decrease in population supplied is accounted for by the alteration of the basis of calculation from 4·25 to 4·125 persons to a house to bring figures in harmony with census returns. The number of houses added during the year was: Inside the borough, 323; outside, 301—total, 624, as compared with 781 before. The number of meters fixed is: Inside the borough, 651; outside, 278—total, 929, compared with 903. During the year, 7084 yards of old water-mains of various sizes were scraped and cleaned.

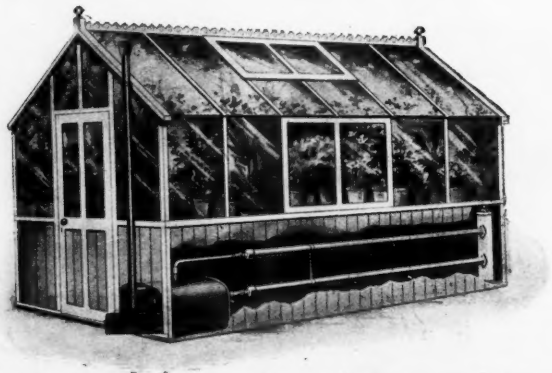
Distribution of Petrol in Pipes.—The General Committee of the Commercial Motor Users Association have had under consideration Sir Marcus Samuel's recent statement that a three-days fog on the river would be followed by a serious interruption, if not complete cessation, of the supply of motor spirit for London, and as this would involve the virtual stopping of all motor omnibus, car, cab, and van traffic, the Committee have decided to bring before the Association, whose members are all the largest consumers in London, a project for the laying of one or more pipe-lines for the conveyance of motor spirit from the Thames Estuary to various parts of London. For this project parliamentary sanction will be required; and the Association will support an application for the necessary powers.

RICHMOND'S "DAISY" GAS BOILER

Suitable for connection to Hot-Water Radiators or to pipes, as shown.

The "DAISY" GAS BOILER is specially constructed for efficient and economical heating of the Greenhouse and Garage.

The "DAISY" has an advantage over other heaters of this class, because it is fitted INSIDE the house, which, in addition to utilizing the Boiler Heat, dispenses with the extra cost of a hutch or cover. Our literature, "PLANT LIFE," supplied free.



The "DAISY" fixed inside the House, showing Outlet Flue, Swing-out Lighting Door, and Circulating Pipes.

Advertisement of the RICHMOND GAS STOVE & METER CO., LTD., London and Warrington.

COOKING AND WATER BOILING.

Gas and Electricity Temperatures and Costs Compared.

In a recent issue of the "Builder," notice was made of a paper by Mr. Harold Gray on "Electric Heating as Applied to Cooking Apparatus." From this it seems that Mr. Gray has devoted some time to the problem of electric-oven design, and believes that the whole secret of success depends on two things—the provision of uniform heat throughout the cooking space, and a steady circulation of the hot air currents in the correct directions to avoid "airlocks" over and around the food. Given these two conditions, the cooking is perfectly uniform throughout the oven, and the door need not be opened periodically for the purpose of changing the position of the objects under treatment. It is essential, however, that there should be a light inside and an inspection window, as well as an interior thermometer indicating the temperature. Mr. Gray has devised what he considers to be an ideal electric oven. Heat is generated by two elements at the bottom; the heated air rising in two side flues formed by plates, emerging at the top into the oven proper. After permeating the cooking space, the heated air again passes over the heating elements, and the cycle is repeated as long as requisite. The oven is surrounded by lagging, from 1½ in. to 2 in. thick, composed of slag wool or finely-divided asbestos. The type of oven described, it is claimed, "represents an immense advance on the ordinary electric, gas, or fuel oven, where too much top, bottom, or side heat usually prevails; its uniformity of temperature, and the perfect distribution of heat, being specially noteworthy features. As compared with a gas-oven, where the food is bathed in the products of combustion of impure gas, the apparatus shows to much advantage, and from figures given by the author it appears that the average cost of operation is not more than that of a gas-oven." The paper, the "Builder" adds, "will probably have the effect of stimulating the endeavours of electrical engineers to advance the application of electricity in the direction indicated, and may be commended to the attention of architects concerned in the equipment of public institutions, hotels, and other buildings where hygienic cooking is an important consideration."

The Davis Gas-Stove Company, Limited, sent the following interesting letter on the subject to our contemporary:

We have just been very much interested to have our attention called to the summary of Mr. Harold Gray's article, which appeared in your issue of Sept. 22, on the subject of electric cooking apparatus. As no figures are given in the summary referred to, direct comparison is practically impossible; but the following remarks may prove of interest to your readers.

Mr. Gray, in his paper, appears to make two statements concerning the electric-oven which require a little consideration. The first of these is: "That a uniform heat is essential"—a statement which, we believe, to be incorrect, as the top heat (which Mr. Gray appears to object to so strongly) is that essential feature of baking which so many ovens do not possess, and are for that reason commercial failures. Further than this, it is necessary that this top heat can be controlled at will, for after it has done its work it is necessary to so modify the heat that a steady soaking temperature is maintained, which demands rapid and complete control of the oven temperature, which is, so far, only obtainable with gas-ovens.

The second statement which calls for attention is that in gas-ovens "the food is bathed in the products of combustion of impure gas." This assertion is certainly liable to misconstruction. Anyone unfamiliar with the chemical considerations of combustion and combination would be extremely liable to infer from the above remark that the combination of poisonous substances is bound to give rise to a poisonous result, which is, of course, not a fact; for if we took hydrogen and oxygen in their combustible proportions, we should have a mixture suitable for respiration, but the result of the combination of this mixture is water—a substance the hygienic properties of which need not be enlarged upon.

Again, we might argue that the combination of two such substances as sodium and chlorine (each in itself most objectionable and unpalatable, not to say poisonous) would produce a substance unfit to eat and of a poisonous nature; but years have proved that common salt, the product of this combination, is nutritious and extremely necessary. In a similar way, experience has proved that the products of gas in a properly-designed cooker in no way affects the food cooked therein, and that these cookers are very good to use.

It would be very interesting to know what improvement Mr. Gray's electric oven represents over and above the best of those we have tested, which give the following results:

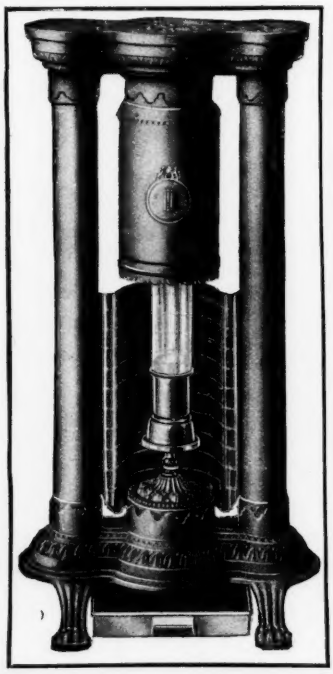
With an oven 14 in. by 12½ in. by 10 in., the oven heat at the start of the test was 61° Fahr. Ten minutes later it had been raised to 390° Fahr.; the current used during the ten minutes being 0·249 unit, representing an hourly rate of 1·494 units of electricity consumed. At the end of the second ten minutes, the temperature of the oven was 530° Fahr.—the current used during this further ten minutes being 0·167 unit, representing an hourly rate of 1·002 units; the total consumption for the twenty minutes being 0·416 unit of electricity. The current was then so regulated that a temperature of 410° Fahr. was maintained in the oven; and it was found that the current necessary to maintain this temperature was 0·532 unit per hour. These tests were supervised and checked by a fully-qualified electrical engineer.

There is one point particularly worthy of note—it was impossible on the particular oven tested to obtain a temperature of less than 410° Fahr.—a temperature somewhat in excess of that required for most cooking operations; and a point which clearly demonstrates the want of control over the heat in electrical ovens.

Having dealt with the oven, we should like to give a few comparative figures on the subject of water-heating; this being of such a nature that direct comparison can easily be made.

An ordinary gas-boiling ring used to heat small quantities of water

The ONLY HYGIENIC
HEATER
which dispenses with flue outlet.



Clark's Patent Syphon Stoves

Careful and varied tests made by a prominent Analytical Chemist have pronounced the Syphon Stove to be thoroughly recommendable on account of the complete utilization of the gas burned. This, and the PURE HEAT generated, make it the most suitable stove for Hospital Wards, Nurseries, and rooms having no flue outlet.

Suitable advertising literature will be sent to any Gas Undertaking, and, although our sales are increasing rapidly, we can deliver immediately.

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will give, at a low estimate, 55 per cent. efficiency net; or, expressed in another way, it will return in the form of heated water, 295 B.Th.U. per cubic foot of gas consumed, which, with gas at 2s. 6d. per 1000 cubic feet, gives a return in heated water of 9823 B.Th.U. per penny. Next, the gas-heated circulating boiler in practice will give an efficiency of 400 B.Th.U. per cubic foot of gas used, which with gas at 2s. 6d. per 1000 cubic feet, will represent 13,320 B.Th.U. per penny. Again, a good geyser as constructed to-day will return in the form of heated water 500 B.Th.U. for every cubic foot of gas used, which represents (with gas at 2s. 6d. per 1000 cubic feet) 16,650 B.Th.U. per penny. As 1 unit of electricity represents, if converted wholly into heat, 3437 B.Th.U., it is easy to calculate the number of units of electricity required to give the same amount of heat per penny, as we have shown, can be returned in the form of heated water by the various methods set out above.

The resulting figures are (in each case the price of gas is assumed to be 2s. 6d. per 1000 cubic feet):

One pennyworth of gas used in a boiling-stove returns 9823 B.Th.U., representing 2·858 units of electricity.

One pennyworth of gas used in a circulator returns 13,320 B.Th.U., representing 3·875 units.

One pennyworth of gas used in a geyser returns 16,650 B.Th.U., representing 4·83 units.

Assuming the low rate for electrical energy of 1d. per unit, the figures given above represent a direct comparison of the cost of gas and electricity—the cost of gas throughout being 1d., the relative cost of electricity is 2·85d. for boiling-stoves, 3·87d. for circulators, and 4·84d. for geysers. But it must be remembered that these figures represent cost calculated for gas as it is actually being used to-day, whereas the calculations for electricity allow for 100 per cent. efficiency, which is not the case to our knowledge.

LONDON COUNTY COUNCIL AND WATER SUPPLY.

Water Charges on the Council's Property.

At the Meeting of the London County Council last Tuesday, the Local Government, Records, and Museums Committee presented the following report.

One of the most important changes effected by the Metropolitan Water Board (Charges) Act, 1907, was to fix rateable value as the basis on which the water-rate was to be charged throughout the limits of supply of the Board. It was feared that the Act would result in the charges for water supplied to the Council being increased considerably; and prolonged negotiations have taken place with the Board on the subject of the bases of the charges to be made for the various properties. We have now had an opportunity of comparing the charges for services other than education with those paid before the passing of the Act of 1907. The net annual increase is £934, or 5½ per cent. The total cost of the water supplied during the year to March 31, 1910 (for all services other than education), including meter-rentals and fixed charges, was £19,189. As regards the education service, the cost of water supplied to elementary and special day schools (over 1000 in number) before April 1, 1908, was approximately £10,500. Under the Act of 1907, the actual cost has averaged £20,500; the latter figure including charges in respect of new schools opened since the estimate was made. In addition, a sum of about £1775 a year is paid in respect of special schools, training colleges, &c. The actual cost will be reduced in future years, owing to the Board having recently made a concession with regard to school premises on one site though separately assessed. The figures for non-provided schools are not included; the liability for making direct payments to the Board having been taken over by the Council since April 1, 1910. Water for non-provided schools is charged for on the same basis as the Council's schools. As, however, non-provided schools are not assessed in the valuation list, it has been necessary to come to an arrangement with the Board. Values have been agreed upon on a satisfactory basis for the majority of schools, and the remainder are being dealt with.

The Committee set forth the principal concessions granted; one being that, while insisting on a minimum charge based on annual value in respect of all properties where water is used for domestic purposes, the Board agreed that on certain classes of very highly assessed property, the minimum charge should be based on a proportion only of rateable value. Reductions of rateable value amounting to upwards of £50,000 have been obtained under this arrangement, mainly in respect of tramway and main drainage properties.

The report was received without debate.

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards placed issues of new capital by order of the Directors of the Pinner and Broadstairs Gas Companies and the Great Marlow Water Company. An issue of £5 "B" shares in the first-named Company, ranking for a standard dividend of 7 per cent., but entitled to a proportion, as from the 1st prox., of the entire dividend for the year ended June 30, 1912 (the dividend for the past year being £9 5s. 6d. per cent.), was all disposed of at £9 10s. and £9 11s. per share. The new issue for the Broadstairs Gas Company consisted of £5000 of ordinary "D" stock and £2000 of 4 per cent. perpetual debenture stock. The former ranked for a standard dividend of 7 per cent., and this is the amount declared; but as it is paid free of income-tax, the distribution is equivalent to about £7 8s. 6d. per cent. per annum, less tax. This stock fetched £125 to £128; and the perpetual debenture stock, £95 to £96. The new issue of the Great Marlow Water Company consisted of 4 per cent. debenture bonds, of which £2100 were sold at par.

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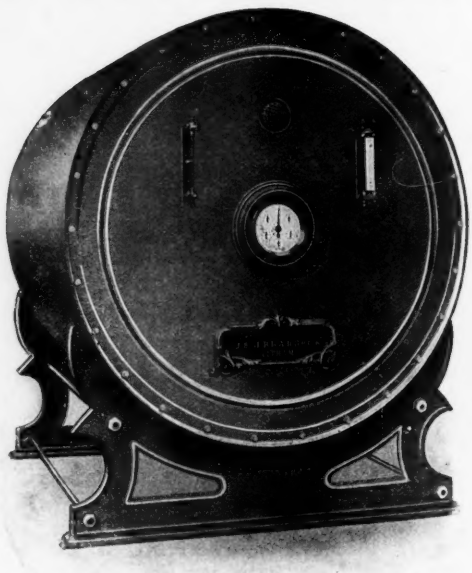
SECOND TO NONE.

Made in all Sizes.



No. 219. Braddock's Large Dry Meter.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the "Aberdeen Daily Journal" of Wednesday last, the following statement was published: "Judging by the orders which have been pouring in upon the Aberdeen Corporation Gas Department for gas-stoves and other appliances during the last three or four weeks, the gas exhibition promoted and held recently by the Town Council has thoroughly justified itself. One of the chief features of the exhibition was the splendid show of gas stoves and fires of various kinds, which must have brought home to the minds of many, perhaps for the first time, the merits of such appliances. Other factors which have no doubt also contributed to the increased demand are the policy adopted, only a month or two ago, by the Gas Department of giving cookers free of charge, and the reduced price of gas, which now stands at 2s. 3d. per 1000 cubic feet. The Gas Department now supplies, free of charge, for each approved customer who makes application, gas cookers, range plates, or grillers, subject to certain conditions. One of the stipulations made is that the gas bill of the consumer using a cooking appliance must show an extra consumption of so many feet per annum. . . . The Gas Department have been hiring gas-cookers for considerably over twenty years, and fires for about ten years; and the number of these appliances on hire up to the end of August was as follows: Cooking appliances, 3609; fires and radiators, 1505—total, 5114. From the end of August, when the policy of free cookers was adopted, until the opening of the gas exhibition, orders for 1036 cookers were taken, as well as for 45 fires and radiators—a total of 1081. During the exhibition, representatives of the exhibiting firms booked orders to the extent of 1301 cookers and 1072 fires; while at the gas-stove shop of the Corporation in Union Street, there were booked orders for 272 cookers on loan, and 49 fires on hire. Since the close of the exhibition, orders have been taken by the Department for 196 cookers on loan, and 22 fires on hire. The figures taken in the aggregate show that, since the beginning of the exhibition, the number of cooking and heating appliances on hire or loan has been increased from 5114 to 9167—a remarkable increase indeed. In consequence of the enormous number of orders, the department have had to increase the staff concerned in the fitting-up of these appliances in the houses and business premises of the consumers; and with such a press of orders it is impossible for all to receive satisfaction at once. . . . The exhibition has also given an impetus to gas lighting, indoors and outdoors."

At a meeting of the Peterhead Town Council on Monday—Provost Leask presiding—Mr. J. Gordon moved that the letter received from the Secretary for Scotland with reference to the management of the Gas Department, and also the report from Messrs. W. Meston and Co., be handed to the representatives of the Aberdeen and local Press for publication. He thought that probably the lapse of a month would have enabled them to come to the conclusion that it was essential to the interests of everybody to make the fullest exposure to the public of these matters. There was no seconder to the motion. Bailie Dickie rose to speak, but was ruled out of order, as the motion could not be discussed on account of its receiving no support. The matter then dropped. The Gas Committee, on the 15th ult., had a discussion with Mr. Irvine, the Town Chamberlain, with regard to the gas treasureship, when eventually he agreed to discharge the duties at present performed by the Gas Treasurer, along with his existing duties as Town Chamberlain, until the term of Whitsunday next, on the same conditions, and for the same emoluments, as the late Treasurer latterly held the appointment. The meeting accordingly authorized Mr. Irvine to obtain delivery from the interim Treasurer of the whole of the books and documents of every description in his possession relating to the gas undertaking.

In the "Dundee Advertiser" of Thursday of this week there appeared an article entitled "Dunfermline's Social Problems," written by a Special Commissioner, whose object apparently was to forecast some of the problems which the Municipality will have to encounter in the administration of the immensely enlarged area which Parliament has placed under their jurisdiction. The writer derived his information largely from interviews with leading citizens. Dealing with the gas undertaking, he wrote: "Most of the residents I chatted with spoke highly of the gas undertaking as an asset of the burgh. In 1897, the works were acquired at a cost of £100,000, and since then a capital expenditure of £26,000 has been made. Mr. Thomas Stewart is Convener of the Gas Committee; and he is proud of the works. Asked about the profits on the undertaking, Mr. Stewart's reply was: 'Profits! The price was 3s. 11d. per 1000 cubic feet in 1897; to-day it is 2s. 3d. for lighting purposes, and 1s. 9d. for heating and power.' Anticipating a large extension of the works in connection with the Rosyth colony, the Town Council have been paying for years a rental of £100 a year for four acres of ground. '£100 a year is a big rental for four acres of ground,' I remarked to a councillor; and the reply is a fair reflection of the enterprising spirit which is being exhibited in Dunfermline. At present, 'we must sow before we reap; and the harvest will come with the new town.'"

Bailie Murdoch, at the Johnstone Town Council yesterday, wanted to know if nothing could be done to improve the quality of the town's gas. It was very bad at present; and in support of this he mentioned that candles had to be secured for the polling-booths on Tuesday, so that electors could see to mark their papers.

The Paisley Town Council have agreed to reduce the price of gas to the village of Linwood from 3s. 3d. to 3s. per 1000 cubic feet.

On Thursday evening, the Edinburgh Fire Brigade were summoned to an outbreak of fire which had occurred in a fruiterer's shop in Union Place. The origin of the fire was traced to an electric cable, which had fused, melted a gas-pipe, and set fire to the gas. Workmen from the Gas Commission were sent to the place; and they found it necessary to take up part of the paving in the street before they could deal with a leaking gas-pipe The fire had burned through three floors. Later in the evening, the Fire Brigade were summoned to another fire, in which case also, it was believed, the outbreak was caused by the fusing of an electric cable.

70

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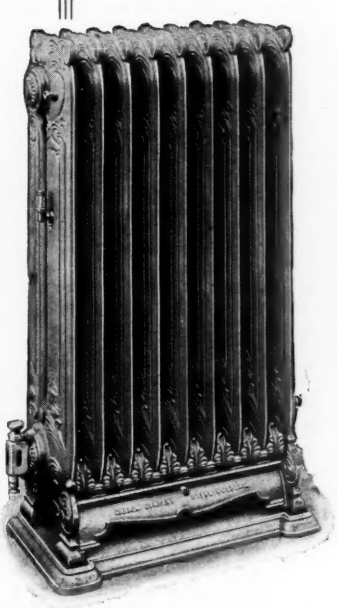


LONDON (City) 15, Upper Thames St., E.C.; (West End) 23, Princes St., Cavendish Sq., W., and 3, Berners St., W.; LIVERPOOL—22-30, Redcross St.; MANCHESTER—24, Brazennose St.; GLASGOW—125, Buchanan St.; EDINBURGH—114, George St.; BRISTOL—6, Victoria St.; NEWCASTLE-ON-TYNE—13, Prudhoe St.; BIRMINGHAM—218, 220, 222, Corporation St.; DUBLIN—44, Grafton St.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 487.]

Sulphate of Ammonia.

LIVERPOOL, *Nov.* 11.

The market has assumed an easier tone during the past week, and the larger output has only been disposed of with some concession in prices. There has been rather a paucity of new orders direct from consumers, and the middlemen have apparently covered all their present requirements. The nearest values at the close are: £14 2s. 6d. to £14 3s. 9d. per ton f.o.b. Hull, £14 3s. 9d. to £14 5s. per ton f.o.b. Liverpool, and £14 6s. 3d. to £14 7s. 6d. per ton f.o.b. Leith. In the forward position, manufacturers continue to quote £14 7s. 6d. to £14 10s. per ton f.o.b. according to the period and the port of shipment; but buyers for the most part remain somewhat apathetic, and no first-hand sales have been reported.

Nitrate of Soda.

On spot, the market is quietly steady at 10s. 1½d. per cwt. for ordinary quality and 10s. 4½d. for refined, the present volume of business not being large.

LONDON, *Nov.* 13.

Tar Products.

The markets for tar products remain very firm. Pitch is in fair demand. Benzols are strong for prompt delivery; but for forward, it is difficult to do business at the prices being asked at the moment. Solvent naphtha is improving slightly; and heavy naphtha is in good demand. Contracts are reported at better prices. There is no change in the position of crude carbolic acid. Creosote is still exceedingly firm for both prompt and forward delivery.

The average values during the week were: Tar, 22s. to 26s. *ex* works. Pitch, London, 40s. 6d. to 41s.; east coast, 40s. to 40s. 6d.; west coast, Clyde 39s. to 39s. 6d.; Manchester 38s. 6d. to 39s.; Liverpool, 39s. to 39s. 6d. Benzol, 90 per cent., naked, London 9¼d. to 10d. f.o.b.; North, 9¼d. to 9⅝d. f.o.b.; 50-90 per cent., naked, London, 8d. to 8¼d.; North, 8d. to 8⅛d. f.o.b. Toluol, naked, London, 9d. to 9¼d.; North, 8¼d. to 8½d. Crude naphtha, in bulk, London, 4¼d. to 4⅜d.; North, 3⅞d. to 4d. Solvent naphtha, naked, London, 9⅜d. to 10d. f.o.b.; North, 8⅜d. to 9¼d. f.o.b. Heavy naphtha, naked, London, 11d. to 11½d. f.o.b.; North, 9¼d. to 10⅛d. f.o.b. Creosote, in bulk, London, 2⅞d. to 3d.; North, 2⅝d. to 2¾d., liquid; 2⅝d. to 2⅞d., salty. Heavy oils, in bulk, 3d. to 3¼d. Carbolic acid, casks included, 60 per cent., west coast, 2s. to 2s. 2d.; east coast, 2s. 1d. to 2s. 3d. Naphthalene, £4 10s. to £10; salts, 45s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

Although this market remains firm, prices are practically unchanged. Buyers seem to be holding off from purchasing at the moment. Actual Beckton is still quoted £13 16s. 3d. to £13 17s. 6d. Outside London makes are £13 10s.; Hull, £14 3s. 9d.; Liverpool, £14 5s.; Leith, £14 7s. 6d.; Middlesbrough, £14 3s. 9d.

COAL TRADE REPORTS.

Northern Coal Trade.

Scarcity of steamers limited the shipments of coal for some days; but the quantities sent out are now about normal, and prices have regained firmness. Best Northumbrian steam coals are steady at 10s. 10d. to 11s. per ton f.o.b. Second-class steams are from 9s. 6d. to 10s. per ton f.o.b.; and steam smalls are from 5s. to 6s. The production is moderately good, and is fairly taken up. In the gas coal trade, the home consumption is a heavy one, and will increase until the end of the year. Best Durham gas coals are from 11s. 6d. to 11s. 7½d. per ton f.o.b., and second-class are about 10s. 3d. per ton. For "Wear specials," from 11s. 9d. to 12s. per ton f.o.b. is the quotation—this class of coals being very well sold for some weeks. There have also been a few sales of cargoes of best Durham gas coals sold forward at about 11s. 4½d.; but no large contracts are reported for the last few days. The output of gas coals is again heavy, and meets the needs; but there is more desire to stock with the dread of labour troubles. Coke is firm. Gas coke is plentiful; good makes being 14s. 3d. to 14s. 9d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

The coal market continues strong. All classes of coal and dross are in active demand, and prices are higher in consequence. Traders are complaining of the want of railway waggons. The prices now quoted are: Ell, 10s. 6d. to 11s. 6d. per ton f.o.b. Glasgow; splint, 11s. 6d. to 11s. 9d.; steam, 10s. to 10s. 3d. The shipments for the week amounted to 338,750 tons—an increase upon the preceding week of 9637 tons, and upon the corresponding week of 30,545 tons. For the year to date, the total shipments have been 140,197,278 tons—an increase upon the corresponding period of 263,958 tons.

Sleaford Electricity Undertaking.—At the monthly meeting of the Sleaford Urban District Council, there was submitted the report of the Local Government Board Auditor, on the accounts for the year ending March 31. This stated, among other matters, that the amount received by the Electricity Department was £803, while the expenditure was £1081 (including repayment of principal and interest on loans). The net adverse balance on the electricity account was £268 at March last, as compared with £256 in 1910. The instalment of principal paid during the year was £307. The revenue showed an increase of £11 over the previous year. The results are not exactly brilliant, when one considers that the Council have spent over £11,000 on capital account, and only have a revenue of £803. Public lighting figures at £481, which is some £200 above the price that used to be paid to the Gas Company—and this is for a less number of hours' lighting by 25 to 30 per cent.

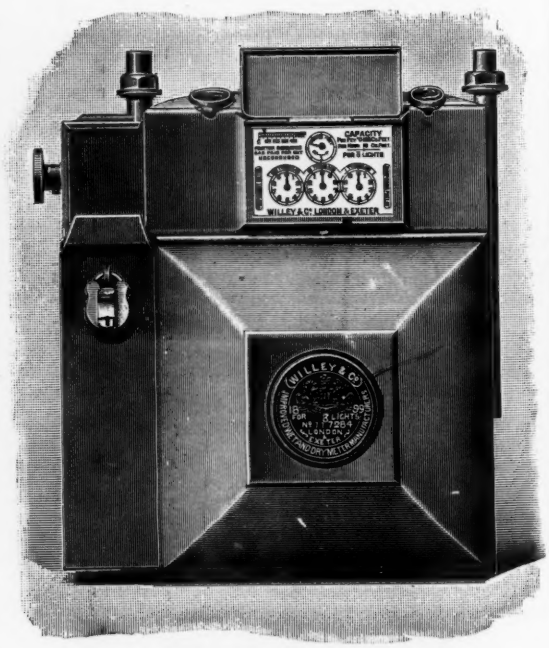
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



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LONDON & EXETER.

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AGENTS FOR SCOTLAND:
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Liability for Contaminated Water Supply.

In the National Insurance Bill as introduced, it was specified in clause 46 that if, as the result of an outbreak of any epidemic, endemic, or infectious disease, there was an excess of sickness in a district, and that it was, in whole or in part, due to an insufficient or contaminated water supply, this was to be made good by the local authority or company by whom the water was supplied, or who, having had imposed upon them the duty of affording a water supply, refused or neglected to do so. The clause, which confers power upon approved societies and local health committees to demand inquiries into the causes of excessive sickness, &c., was discussed at some length in the House of Commons last Thursday, with the result that the portion specially bearing upon water supply was amended by the addition of the words "unless the local authority or company prove that such insufficiency or contamination was not due to any default on the part of the authority or company, but arose from circumstances over which it had no control."

The Chairmanship of the Manchester Gas Committee.—At last Friday's meeting of the Manchester Gas Committee, Mr. W. Kay was unanimously elected Chairman in succession to the late Alderman Gibson. About six months ago, on the death of Alderman Briggs, the Deputy-Chairman of the Gas Committee, Mr. Kay relinquished his position as Deputy-Chairman of the Electricity Committee to take up that of the Gas Committee, of which he has been a member about nine years. Alderman Jennison, a very old member of the Gas Committee, has been elected Deputy-Chairman.

Electric Light Failure at Cardiff.—Considerable inconvenience was caused last Saturday week, in the Roath district of Cardiff, by the failure of the electric light a few minutes before six o'clock, just as the shops were busy with customers making their weekly purchases. Paraffin lamps and candles were brought into service as quickly as possible. The light was restored shortly before seven, but only for two minutes. It returned permanently, however, at five minutes past seven. In most cases where shops were lighted by electricity, there was no gas service; and we learn from a local paper that the tradesmen in the district are now considering the urgent advisability of having a second illuminant available in case of need.

Connection of Water-Mains North and South of the Thames.—The Metropolitan Water Board have had under consideration for some time the question of the connection of the water supplies north and south of the Thames, and they applied to the London County Council for permission to lay a main 20 inches in diameter through Woolwich Tunnel. At the meeting of the Council last Tuesday, the Improvements Committee reported that they had been advised that, for the purpose of securing a continuous supply of water on both sides of the river, it was very desirable that some such communication as that proposed should be established; and they had accordingly been in negotiation with the Board with a view to a preliminary arrangement being arrived at. As the result of these negotiations, the Board had agreed to execute the work in accordance with the Council's requirements. The Committee recommended that, subject to the Board agreeing to pay any licence dues assessed by the Port of London Authority, they should be allowed to lay the main, in consideration of the payment of an annual charge to be subsequently agreed upon or settled by arbitration. The recommendation was adopted without discussion.

Teignmouth Gas Manager's Salary.—The Teignmouth District Council had under consideration last Tuesday a report by the Gas Committee recommending that the salary of the Gas Manager (Mr. J. A. Gray) be increased by £25 per annum, in view of his services in the erection of new purifiers and the extension of the retort-house. Mr. Turpin proposed that the matter be referred back to the Committee. He said the Gas Manager had a year ago received £50 for extra services, and in addition to his present salary was allowed to do outside work. He acknowledged that Mr. Gray had done service for the town; but he submitted that the remuneration proposed was out of proportion to that paid to other officials of the Council. Mr. Harris said the application by the Gas Manager for an increase of salary arose in consequence of the work done by him beyond his ordinary duties. In recommending the increase, the Committee decided that in future the salary should include remuneration for all extra work. He moved that this be added to the recommendation. Mr. French pointed out that Mr. Gray was doing all the work of his department himself, and he believed the inhabitants generally would agree that his splendid services deserved recognition. The recommendation of the Committee, with the addition proposed by Mr. Harris, was agreed to; the only dissentient being Mr. Turpin.

Tarless Fuel Syndicate, Limited.—The ordinary general meeting of this Company was held last Friday, at Winchester House, E.C.—Mr. Arthur Marshall in the chair. The Secretary (Mr. A. J. Green) having read the notice convening the meeting, the Chairman moved the adoption of the report. He said the Directors had found it necessary to expedite matters in relation to their subsidiary Company—the Premier Tarless Fuels, Limited. Their plans had reached such a stage that it was necessary to have the confirmation of the shareholders as quickly as possible, as the sooner the Company arrived at a profit-earning stage the better. The Board were of opinion that the opening of their new works at Barking would herald the dawn of a new era in fuel consumption, and would be of marked significance to the users of suction gas plants where anthracite coal was used, as the superiority of their fuel over anthracite had been proved beyond question. The Company were opening up in this country, and particularly in London, commodities that would not only be profitable to them, but which would be economical to the users. They would be able to keep a stock at their works in Battersea sufficient to create a market pending the erection of their new works, which were on a siding of the London and Tilbury line, and were considered an ideal position for their particular business. They were able to sell their tar practically on the spot. The Directors expected that by this time next year they would have sufficient machinery to treat 100 tons of coal daily. The report was unanimously adopted.

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(With attachment detached.)

MAKERS OF THE

"POSITIVE" PREPAYMENT METER.

Simple in Action.

Positive in Results.

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Electrical Works Destroyed by Fire.—A fire broke out last Tuesday night at 77, Upper Thames Street—a large, solidly-built structure, which had recently been acquired by the British Thomson-Houston Company, Limited, electrical engineers' manufacturers. The work of fitting up the place had been practically completed, and an additional floor had been constructed at the top. It was on this floor that the fire broke out, and some of the employees were actually engaged in the lower rooms when the first engines arrived. The top floors were practically burnt out; but the bottom portion of the premises was saved. The cause of the fire has not been stated.

Municipal Employees' Threat of a General Strike.—According to Councillor J. T. Jones, Organizing Secretary to the Municipal Employees' Association for the Manchester District, there is a possibility of a general strike before long of corporation workers in Lancashire and adjoining counties, unless the respective committees of town councils concede certain demands as to wages and conditions which have been submitted to them by the officials of the Association on behalf of the men. Councillor Jones, in the course of an interview, said it was not unlikely that the men, in the event of a national railway strike, might take advantage of it to cease work with a view to enforcing their demands. He added that the concessions asked for are receiving consideration by a number of corporations; but from some unfavourable replies have been received.

Additional Capital for the Chapel Whaley and District Gas Company.—It will be seen, from an announcement which appears elsewhere, that the above-named Company are inviting tenders for an issue of £20,000 of ordinary shares. It may be remembered that the Company purchased the undertakings at Chapel-en-le-Frith and Whaley Bridge; and parliamentary powers have lately been obtained over a large and busy area. The old works were bought direct from the previous owners, so that there are no intermediate profits. The business has increased at a remarkable rate; and on the first year's working a dividend of 3 per cent. was recommended, with a carry-forward of £219. The authorized capital is £45,000, of which £20,000 has already been issued; and there are no debentures. As mentioned in another part of the "JOURNAL," Mr. Eugene Meunier, son of Mr. S. Meunier, of Stockport, has just been appointed Manager; and as the Directors are all capable business men, the Company should be a progressive one.

International Smoke Abatement Exhibition.—The first meeting of the Vice-Presidents and Council of this Exhibition, which will be held at the Royal Agricultural Hall, Islington, from March 23 to April 4, 1912, took place recently at the Holborn Restaurant, Dr. H. A. Des Voeux, the Treasurer of the Coal Smoke Abatement Society, presided; and among the large and representative gathering were Sir William Richmond (President of the Society), Sir William Ramsay (President of the British Association), Mr. R. G. Shadbolt (President of the Institution of Gas Engineers), Mr. W. Chubb (Secretary of the Coal Smoke Abatement Society), Mr. D. Milne Watson (General Manager of the Gaslight and Coke Company), and Mr. F. W. Bridges (Organizing Manager of the Exhibition). The Chairman having explained the reason which had actuated the Coal Smoke Abatement Society in resolving to take the lead in the organization of an International Smoke Abatement Exhibition, it was resolved that the following Sub-Committees should be appointed: Conference; Domestic Heating (Gas, Electric, Smokeless Fuels, General); Industrial and Motive Power Plants (Boilers and Accessories); Ventilating and Dust Prevention. An informal dinner, at which Sir William Richmond presided, followed the meeting.

APPLICATIONS FOR LETTERS PATENT.

23,966.—DORRINGTON, A. A., and COATES, H., "Generating light and heat from hydrocarbons." Oct. 30.
23,985-6.—STIMSON, E. F., "Gas-cookers." Oct. 30.
24,015.—FLECHTNER, C., "Purifying gases," Oct. 30.
24,022.—CORTHESY, J. H. & J. H., JUN., and DICKSON, W. K. L., "Rotary compressors." Oct. 30.
24,024.—MILBOURNE, R. J., WRIGHT, H. F., and C. & W. WALKER, LTD., "Production of sulphate of ammonia and the purification of gas." Oct. 30.
24,087.—MARTIN, H. M., "Compressors." Oct. 31.
24,117.—SCHOMBURG, L., "Pipe-joints." Oct. 31.
24,125.—NICHOLS, C., "Gas stoves and heaters." Oct. 31.
24,127.—GAUTREAU, L. J. "Burners." Oct. 31.
24,143.—REISERT, H., "Pressure-equalizing devices." Oct. 31.
24,150.—BRUNTON, J. L. & W. P., "Controlling the flow of liquids in pipes." Oct. 31.
24,168.—EVERY, J. W., and KEMPTON, C. H., "Preventing the choking of gas pipes and cocks by naphthalene." Oct. 31.
24,169.—NICKLES, C. A., "Gas-generators." Oct. 31.
24,201.—STEINHART, O. J., and TWITE, H. L., "Manufacture of ammonia and hydrocyanic acid from producer gas." Nov. 1.
24,210.—ROSE, A., BELLAMY, W., and DOLPHIN, J., "Incandescent burners." Nov. 1.
24,212.—POWELL AND HANMER, LTD., and HANMER, F., "Acetylene generators." Nov. 1.
24,341.—KENT-JOHNSTON, A. G., "Lighting and extinguishing gas-lamps." Nov. 2.
24,346.—KILBURN, R., and J. HOPKINSON AND CO., LTD., "Valves." Nov. 2.
24,397.—FYFE, P., "Gas fires and ovens." Nov. 3.
24,403.—O'CONNOR, H., "Inverted burners." Nov. 3.
24,430.—ROUSE, E. E., "Lighting and extinguishing gas-lights." Nov. 3.
24,448.—HAVERS, E. W., and TELEPHOS DOMESTIC AND STREET LIGHTING COMPANY, LTD., "Electrically igniting gas." Nov. 3.
24,461.—RAGOT, E., and PIERRE-HERVOTTE, P., "Gas-producers." Nov. 3.
24,486.—HARRISON, H. T., "Lanterns for street lighting." Nov. 3.
24,503.—HARRISON, S. C., "Chandelier-chains." Nov. 4.
24,548.—CARPENTER, C. C., "High-pressure incandescent gas-lamps." Nov. 4.
24,567-8.—MEYER, F., "Signalling-device for gas-pipes." Nov. 4.

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The Popular Priced Fires.

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The well-known

GAS-HEATED STEAM RADIATOR

(Single or Double Column)

Supplied with flue connection when required.

THE

PARKINSON STOVE CO., LTD.

(Incorporating Maughan's Patent Geyser Co.),

BIRMINGHAM & LONDON.

As announced in the "JOURNAL," Mr. Edward Garvey will offer for sale, by order of the Directors at the Ship Hotel, Grimsby, next Friday, £3000 of new ordinary stock of the Cleethorpes Gas Company. It ranks for a standard dividend of 5 per cent. per annum, subject to the sliding-scale, under which, at the present price of gas, the authorized rate is £7 7s. 6d. per cent.; and this dividend was paid for the half year ended the 30th of June last.

An application by the gas-meter inspectors in the employ of the Rochdale Corporation for an increase in wages has been referred by the Gas Committee to the Works Sub-Committee. It is pointed out by the men, whose present wages are about 30s. a week, that six years have elapsed since the last advance in wages was granted to them; that in the meantime their duties have become more onerous, in consequence chiefly of the extended use of slot-meters by the gas consumers.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments Vacant.

MANAGER (Gas and Water). Atherton Urban District Council. Applications by Nov. 22.

MANAGER. No. 5480.

JUNIOR CLERK. Dorking Gas Company.

Appointments Wanted.

HEAD CLERK AND CASHIER. No. 5479.

REPRESENTATIVE (Lamps and Fittings, &c.). No. 5474.

ASSISTANT GENERAL MANAGER (Gas-Stove Trade). No. 5476.

Plant, &c. (Second-Hand), for Sale.

RETORTS, CONDENSERS, ROTARY METER, WASHER, PIPES AND BENDS. Wolstanton Gas Department. Tenders by Nov. 20.

Plant, &c. (Second-Hand), Wanted.

GASHOLDERS AND STEEL TANKS. No. 5478.

Patent, &c., for Disposal.

TREATING GAS FOR TRANSPORT. F. V. 5429, c/o Rudolf Mosse, Berlin.

Stocks and Shares.

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY. By Auction. Nov. 28.

CHAPEL WHALEY AND DISTRICT GAS COMPANY. By Tender. Dec 1.

EAST GRINSTEAD GAS AND WATER COMPANY. By Auction. Dec. 5

HERNE BAY GAS AND COKE COMPANY. By Auction. Nov. 28.

HYTHE AND SANDGATE GAS COMPANY. By Auction. Nov. 28.

SOUTHEND WATER-WORKS COMPANY. By Auction. Nov. 28.

SOUTHEND WATER-WORKS COMPANY. By Auction. Dec. 5.

TENDRING HUNDRED WATER-WORKS COMPANY. By Auction. Nov. 28.

Meeting.

ORIENTAL GAS COMPANY. London Office Nov. 29. Twelve o'clock.

TENDERS FOR

Fire-Clay Goods.

SHEFFIELD UNITED GASLIGHT COMPANY. Tenders by Dec. 1.

Purifier Boxes.

SHEFFIELD UNITED GASLIGHT COMPANY. Tenders by Dec. 5.

Steel Roof and Floor.

SHEFFIELD UNITED GASLIGHT COMPANY. Tenders by Dec. 5.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Nov. 11. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar, crude	per ton	—	20/- 25/6	22/- 26/-	21/- 26/-	21/- 25/-	—
Pitch	,,	42/6	40/-	40/6	40/6	39/6	40/-
Benzol, 90%	per gallon	—	-/11⅜	-/11⅛	-/11¼	-/11	-/11
Benzol, 50-90%	,,	—	-/11⅛	-/10½	-/11½	-/11¼	—
Toluol, 90%	,,	—	-/11⅛	-/10½	-/10	-/10⅞	-/10¾
Crude naphtha, 30%	,,	—	-/4½	-/4½	-/4⅛	-/4	—
Light oil, 50%	,,	—	-/3½	-/3½	-/3⅛	-/4	—
Solvent naphtha, 90-160	,,	—	-/11	-/10	-/10¼	-/10¼	-/11½
Heavy naphtha, 90-190	,,	—	-/11⅛	-/11	-/11¼	-/11⅛	-/11½
Creosote in bulk	,,	-/3	-/2⅜	-/2⅜	-/2⅜	-/2⅜	-/2
Heavy oils	,,	—	-/2⅜	-/2½	-/2¾	-/2¾	-/2¾
Carbolic acid, 60's	,,	2/5	2/2½	2/3	2/2	2/1½	2/2
Naphthalene, crude drained salts	per ton	—	43/9 45/-	42/6	47/6	50/-	—
,, pressed	,,	—	61/3	63/-	61/3	60/- 75/-	—
,, whizzed	,,	—	—	—	71/3	65/- 75/-	62/6
Anthracene	per unit	-/2	-/1½	-/1½	-/1¼	-/1¼	—

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O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

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PALMERSTON HOUSE,
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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
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ALSO
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126, BISHOPSGATE, E.C.
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